

SA900/901 Diskette Storage Drive

Maintenance Manual

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3.1 MAINTENANCE FEATURES

3.1.1 Alignment Diskette

The SA120 Alignment Diskette is used for alignment of the SA900/901/902. The following adjustments can be made using the SA120.

1. R/W Head radial alignment using track 38.
2. Index Photo-transistor alignment using tracks 01 and 76.
3. Track 00 is recorded with standard IBM 3740 format.

Caution should be exercised in using the SA120 Alignment Diskette. Tracks 00, 01, 36, 37, 38, 39, 40, 75, and 76 should not be written on. To do so will destroy pre-recorded tests.

3.1.2 SA809 Exerciser

The SA809 Exerciser was designed as a piece of test equipment for the SA900/901 Diskette Drive. The Exerciser is capable of performing the following functions

1. Seek - Incremental or alternate tracks
2. Read
3. Write - 1F or 2F
4. Load Head
5. Recalibrate to track zero

The exerciser is provided with switches and indicators to perform the listed functions.

3.1.3 Special Tools

The following special tools are available for performing maintenance on the SA900/901/902.

Description	Part Number
Alignment Diskette	SA120
Cartridge Guide Adj. Tool	50377-0
Head Penetration Gauge	50380-0
Head Load Bail Gauge (old)	50383-0
Load Bail Gauge (new)	50391-0
Load Button Pliers	50933-0
Head Cable Extender (902)	50466-0
Drive Cable Extender (902)	50467-0
Extended Belt (902)	50464-0
Exerciser	50620-0
Spanner Wrench	50752-0

3.2 DIAGNOSTIC TECHNIQUES

3.2.1 Introduction

Incorrect operating procedures, faulty programming, damaged diskettes, and “soft errors” created by airborne contaminants, random electrical noise, and other external causes can produce errors falsely attributed to drive failure or misadjustment.

Unless visual Inspection of the drive discloses an obvious misalignment or broken part, attempt to repeat the fault with the original diskette, then attempt to duplicate fault on second diskette.

3.2.2 “Soft Error” Detection and Correction

Soft errors are usually caused by:

1. Airborne contaminants that pass between the read/write head and the disk. Usually these contaminants can be removed by the cartridge self-cleaning wiper.
2. Random electrical noise that usually lasts for a few μ sec.
3. Small defects in the written data and/or track not detected during the write operation that may cause a soft error during a read.

The following procedures are recommended to recover from the above mentioned soft errors:

1. Reread the track ten (10) times or until such time as the data is recovered.
2. If data is not recovered after using step 1, access the head to the adjacent track in the same direction previously moved, then return to the desired track.
3. Repeat step 1.
4. If data is not recovered, the error is not recoverable.

3.2.3 Write Error (Reference Figure 1B)

If an error occurs during a write operation, it will be detected on the next revolution by doing a read operation, commonly called a “write check.” To correct the error, another write and write check operation must be done. If the write operation is not successful after ten (10) attempts have been made, a read operation should be attempted on another track to determine if the media or the drive is failing. If the error still persists the Diskette should be swapped and the above procedure repeated. If the failure still exists, consider the drive defective. If the failure disappears, consider the original diskette defective and discard it.

3.2.4 Read Error (Reference Figure 1A)

Most errors that occur will be “soft” errors. In these cases, performing an error recovery procedure will recover the data.

3.2.5 Seek Error (Reference Figure 1C)

Stepper malfunction.

3.2.6 Index/Sector Error (Not Ready) (Reference Figure 1D)

Initial indication is usually a not ready.

3.2.7 Test Points — 900/901

TP	0	+ Door Closed
	1	Read Data Signal
	2	Read Data Signal
	3	Read Data (Differentiated)
	4	Read Data (Differentiated)
	5	Ground
	6	Ground
	7	+ Power On Reset
	9	[(Head Load + Door Closed) • Write Gate]
	11	– Load Head
	12	– Index and 901 Sector Pulses
	13	+ File Inop
	15	+ Write Gate • $\overline{\text{Write Protect}}$
	16	+ Read Data
	21	– Data Window
	24	– Data Window
	25	+ Write Protect
	26	+ TRK \emptyset
	27	– STEP • $\overline{\text{WRITE GATE}}$
	35	– Write Gate • $\overline{\text{File Inop}}$

3.2.8 Test Points — 902

TP	1	Read Data Signal
	2	Read Data Signal
	3	Read Data (Differentiated)
	4	Read Data (Differentiated)
	5	Ground
	6	Ground
	8	Ground
	12	– Index
	16	+ Read Data
	21	– Data Window
	24	– Data Window
	26	+ Track Zero Drv 1
	27	+ Track Zero Drv 2



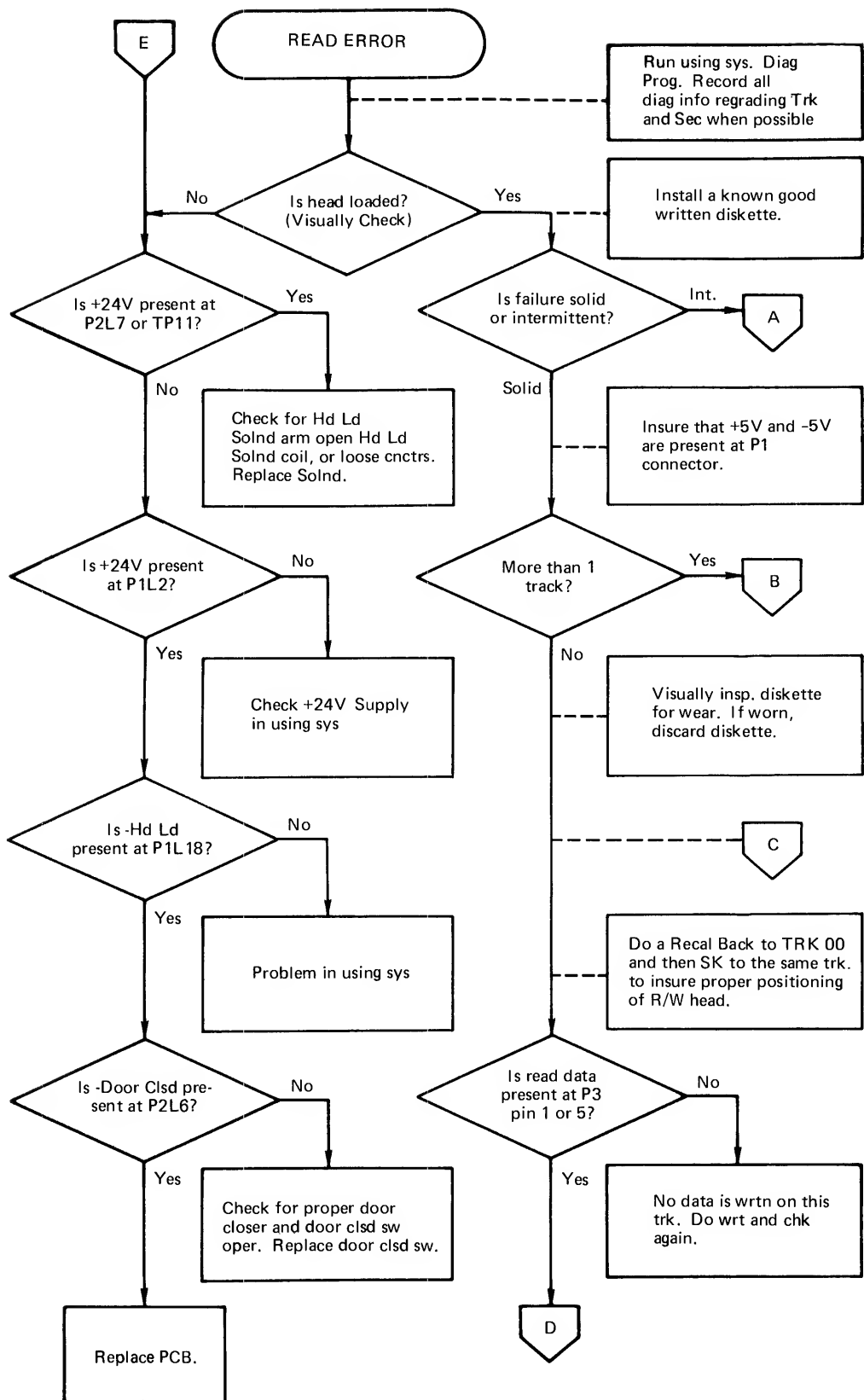


Figure 1A

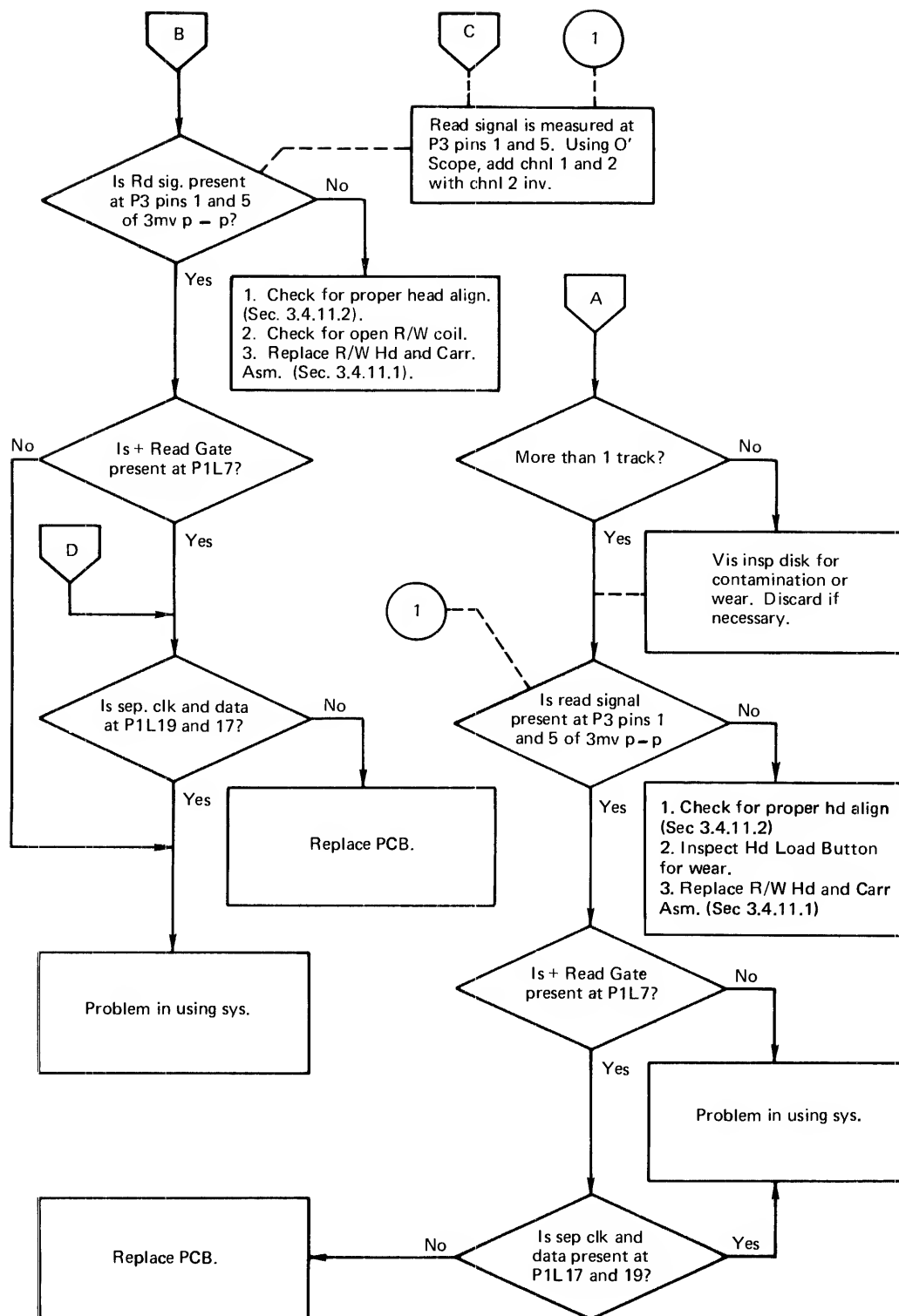


Figure 1A (Continued)

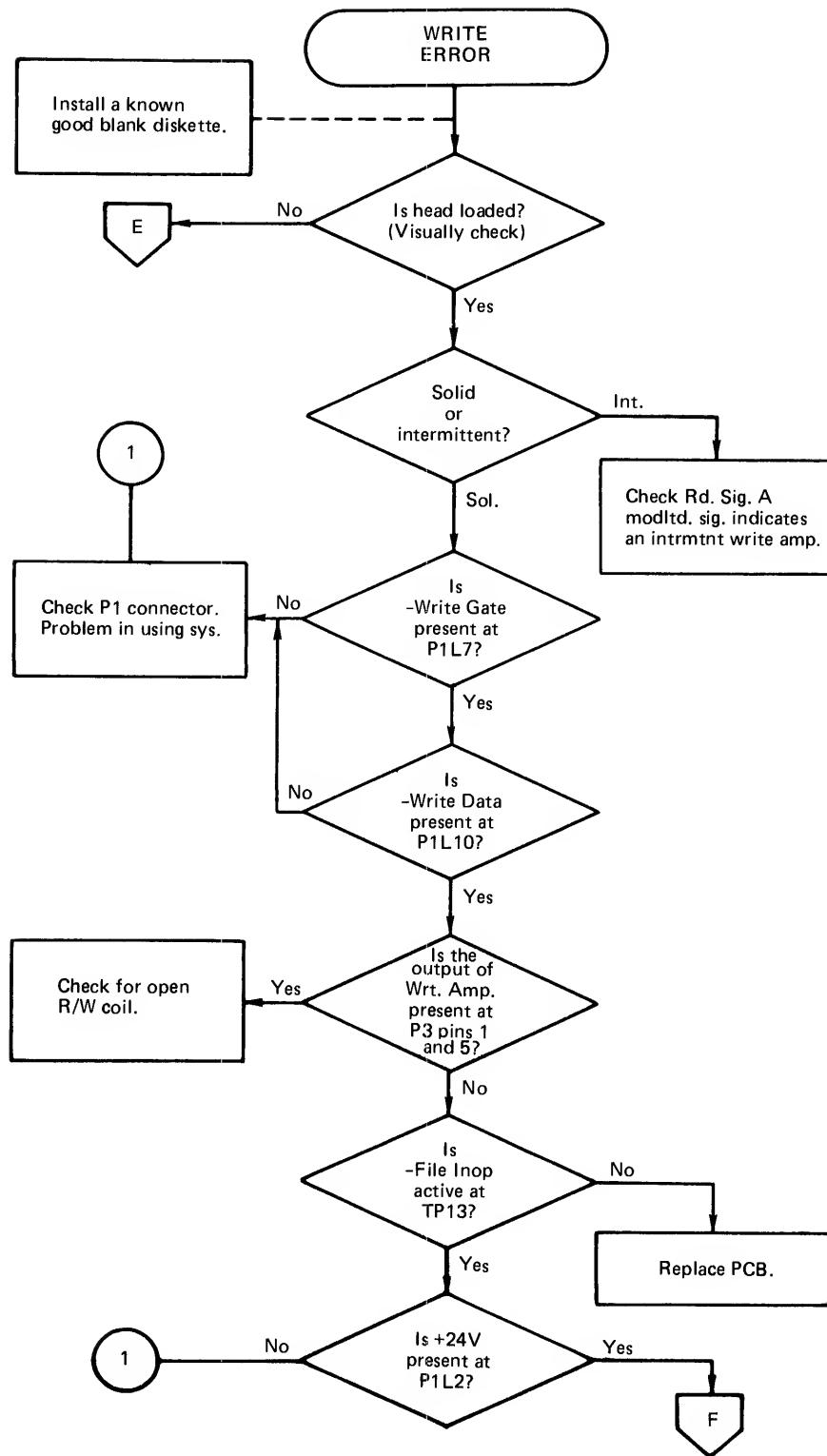


Figure 1B

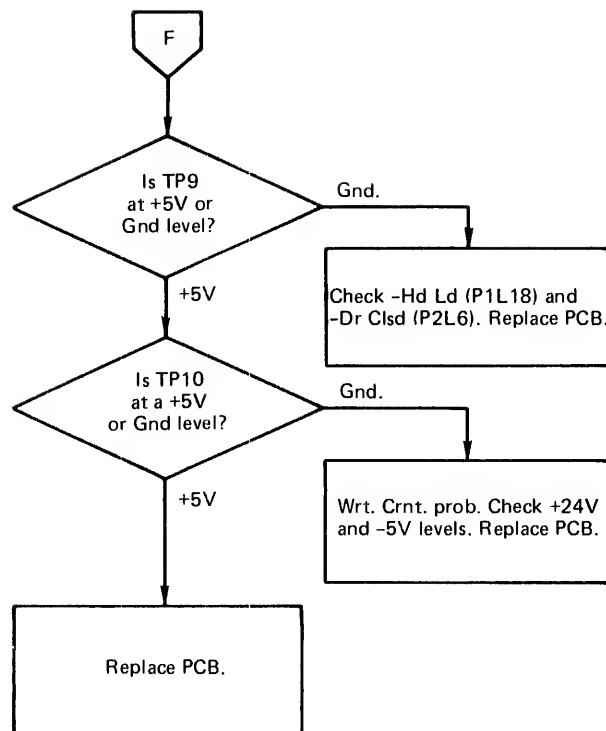


Figure 1B (Continued)

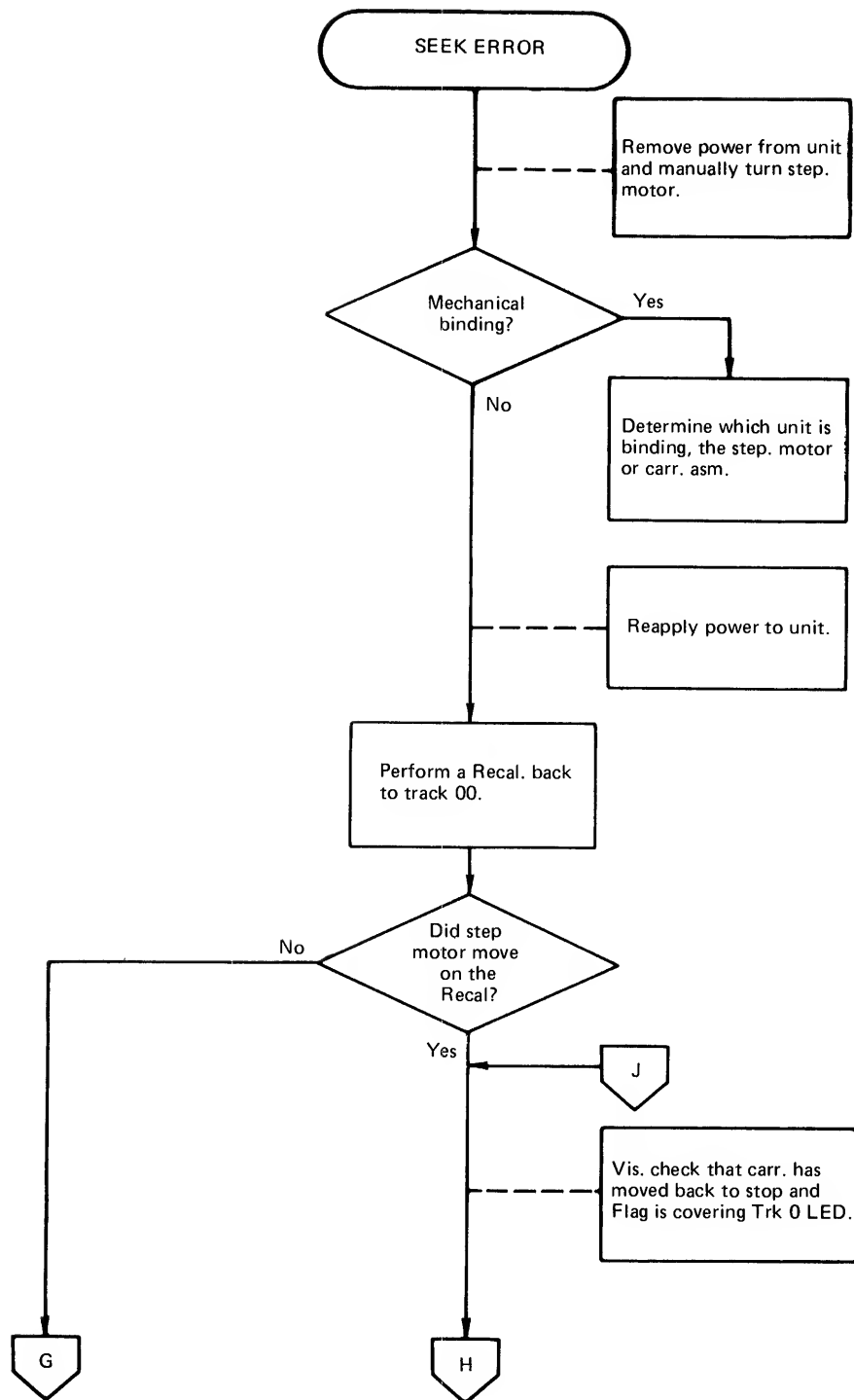


Figure 1C

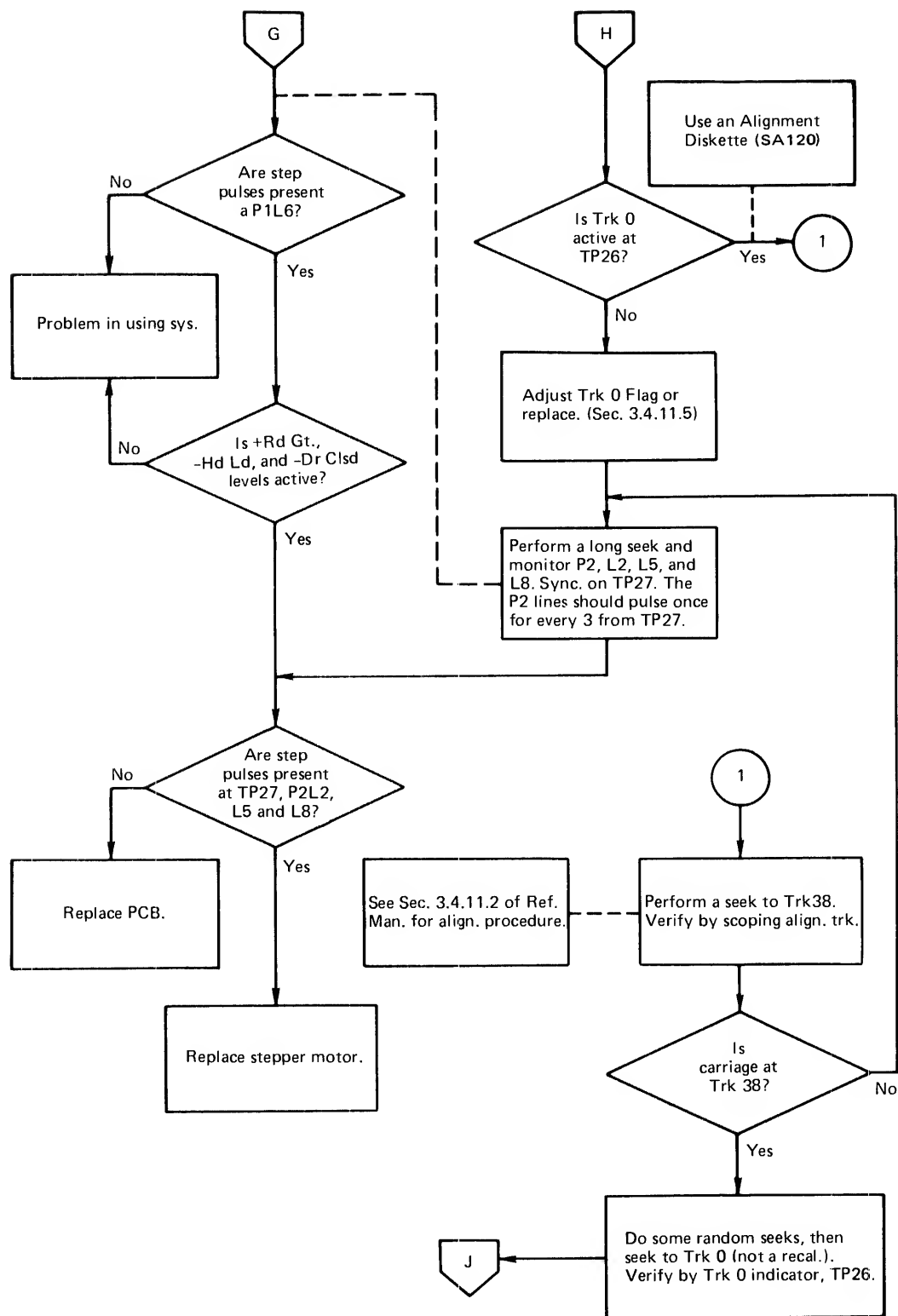


Figure 1C (Continued)

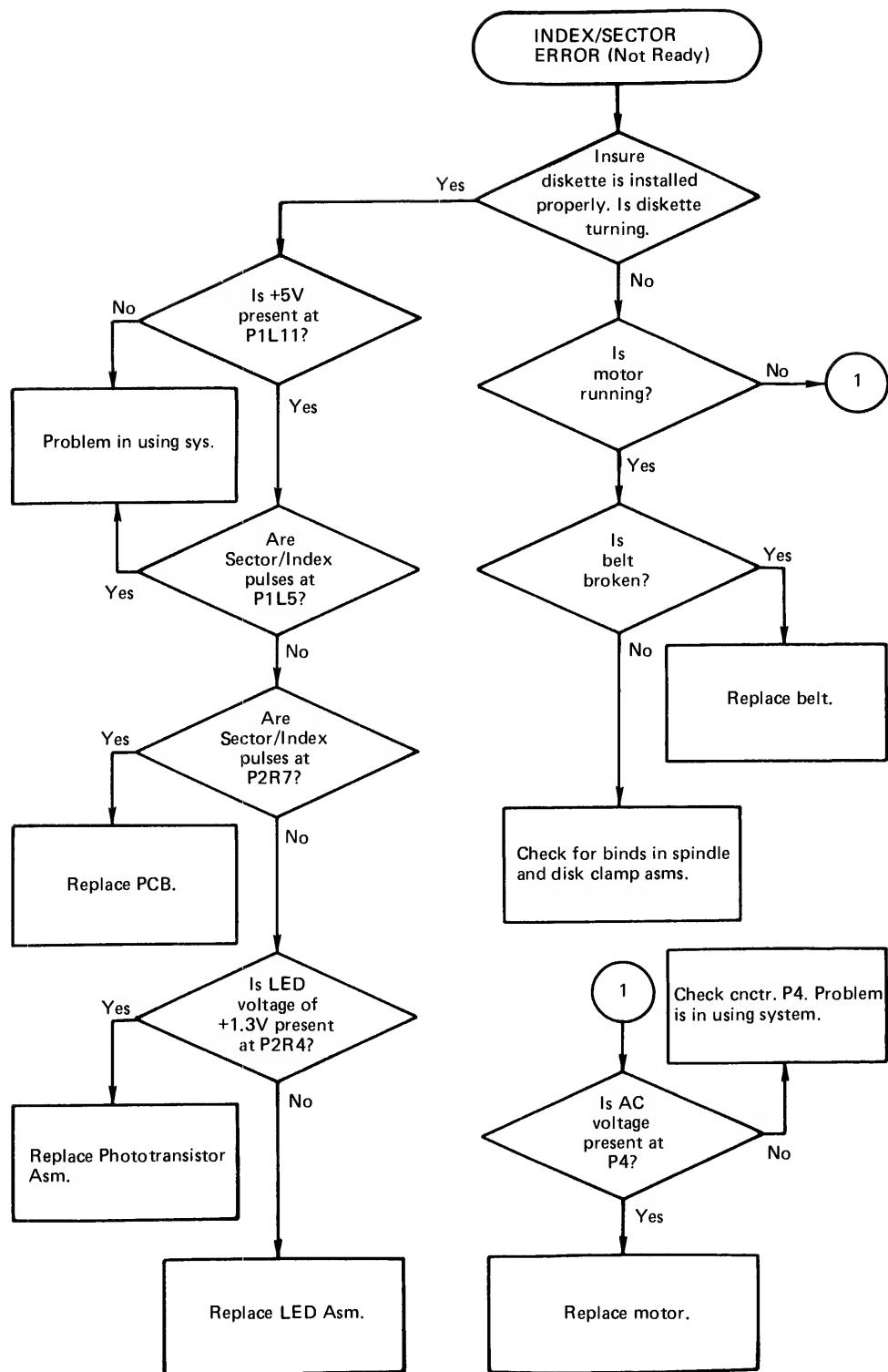


Figure 1D

3.3 PREVENTIVE MAINTENANCE

3.3.1 Introduction

The prime objective of any preventive maintenance activity is to provide maximum machine availability to the user. Every preventive maintenance operation should assist in realizing this objective. Unless a preventive maintenance operation cuts machine downtime, it is unnecessary.

Visual inspection is the first step in every scheduled maintenance operation. Always look for corrosion, dirt, wear, binds, and loose connections. Noticing these items during PM may save downtime later.

Remember, do not do more than recommended preventive maintenance on equipment that is operating satisfactorily.

3.3.2 Preventive Maintenance Procedures

Details of preventive maintenance operations are listed in Figure 2. During normal preventive maintenance, perform only those operations listed on the chart for that preventive maintenance period. Details on adjustments and service checks are found listed in the chart. Observe all safety procedures.

3.3.3 Cleanliness

Cleanliness cannot be overemphasized in maintaining the SA900/901. Do not lubricate the SA900/901; oil will allow dust and dirt to accumulate. The read/write head should be cleaned but only when signs of oxide build up are present.

UNIT	FREQ MONTHS	CLEAN	OBSERVE
Read/Write Head	12	Clean Read/Write Head ONLY IF NECESSARY	Oxide build up and scratches
R/W Head Load Button		Replace	
Stepper Motor and Lead Screw		Clean off all oil, dust, and dirt	Inspect for nicks and burrs
Belt			Frayed or weakened areas
Base	Initially 3 Thereafter 12	Clean base	Inspect for loose screws, connectors, and switches
Read/Write Head			Check for proper alignment

Fig 2 PM Procedures

3.4 REMOVALS, ADJUSTMENTS

For parts location, see Section 3.6.

3.4.1 Motor Drive

3.4.1.1 Drive Motor Assembly: Removal and Installation

- a. Extract 3 contacts to disconnect motor from AC connector.
- b. Loosen two screws holding capacitor clamp to the base. Remove rubber boot and disconnect motor leads from capacitor.
- c. Remove connectors from PCB and remove PCB.
- d. Remove belt from drive pulley.
- e. Remove 4 screws holding the motor to the base casting and remove motor.
- f. Reverse the procedure for installation.

Note: Insure ground lead is installed between capacitor clamp and base.

3.4.1.2 Motor Drive Pulley

- a. Loosen set screw and remove pulley.
- b. Reverse procedure for installation.

Note: When installing a new pulley, the drive pulley must be aligned with the spindle pulley so that the belt tracks correctly.

3.4.2 Side Cover: Removal

- a. Retract screw from upper casting wall sufficiently to allow the side cover to be rocked out.
- b. Lift cover off screw in lower casting wall.

3.4.3 Cartridge Guide Access

- a. Remove side cover (Section 3.4.2).
- b. Position head to approximate center of head load bail (to prevent load arm tab from slipping off end of bail).
- c. Loosen 2 screws holding cartridge guide to door latch plate.
- d. Swing cartridge guide out.
- e. When the guide is swung in, it must be adjusted as per Section 3.4.9.2.

3.4.4 Light Emitting Diode Assembly: Removal and Installation

- a. Remove side cover (Section 3.4.2).
- b. Disconnect the wires to the LED terminals (solder joints).

- c. Swing out the cartridge guide assembly (Section 3.4.3).
- d. Remove the screw and nut holding the LED assembly to the cartridge guide.
- e. Reverse the procedure for installation.
- f. Check index timing and readjust if necessary.

3.4.5 Write Protect Detector: Removal and Installation

- a. Remove connectors from PCB and remove PCB.
- b. Extract wires from P2 connector, pins L3, L4, R5 (E), and R8 (S).
- c. Remove cable clamps.
- d. Remove side cover (Section 3.4.2).
- e. Swing out cartridge guide assembly (Section 3.4.3).
- f. Remove screw holding the detector bracket and remove assembly.
- g. Reverse procedure for reinstalling. Connect the wires to P2 by the following: Red to '3' (L3), Grey to '4' (L4), Black to 'E' (R5) and White to 'J' (R8).

3.4.5.1 Write Protect Detector Adjustment

- a. Insert SA101 diskette into drive. Write protect hole must be open.
- b. Set oscilloscope to AUTO sweep, 2V/div. and monitor P2L4.
- c. Loosen screw on detector assembly and adjust until maximum amplitude is achieved. Tighten screw.

3.4.6 Head Load Actuator

3.4.6.1 Head Load Actuator: Removal and Installation

- a. Remove side cover (Section 3.4.2).
- b. Disconnect the wires to the actuator terminals (solder joints).
- c. Swing out the cartridge to guide assembly (Section 3.4.3).
- d. Remove screw holding the actuator to the cartridge guide.

CAUTION: Restrain the head load arm to prevent its impact with the head.

- e. Reverse the procedure for installation.

3.4.6.2 Head Load Actuator Physical Adjustment (old style)

- a. Remove side cover.
- b. Step carriage to Track 00.

- c. Energize coil either using tester or manually grounding pin L18 on connector P1.
- d. Loosen bail screw on Head Load Bail.
- e. Using Bail Gauge (p/n 50383), adjust bail so that Head Load Arm just touches shim. Tighten screw until just snug. Insure that load arm is over bail when carriage is at Track 00.
- f. Step carriage to Track 76 and check that arm still just touches shim. (This will result in Head Load Bail to Head Load Arm clearance of .020"). Insure that load arm is over bail when carriage is at Track 76. Reference figures below.
- g. Tighten Head Load Bail screw.
- h. Replace side cover.

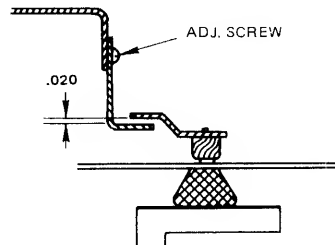


FIGURE 3 HEAD LOAD BAIL TO HEAD LOAD ARM ADJUSTMENT (OLD STYLE)

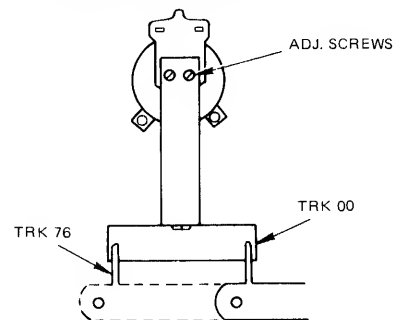


FIGURE 4 HEAD LOAD ACTUATOR LATERAL ALIGNMENT (OLD STYLE)

3.4.6.3 Head Load Actuator Physical Adjustment (new style)

- a. Remove side cover.
- b. Energize Head Load Coil by grounding TP11.
- c. Place Head Load Actuator adjustment tool, P/N 50391, on platen.
- d. Adjust down stop so as the top of Head Load Bail is flush with top of tool within $\pm .005''$ at track 76. Reference Figure 6.
- e. Step carriage to track 38.
- f. De-energize Head Load Coil.

- g. Place adjustment tool onto R/W Head and place load button in cup of tool.
- h. Adjust up stop on actuator so that bail just touches Head Load Arm within $\pm .005''$. Reference Figure 5.
- i. Energize Head Load Coil and step carriage between track 00 and 76. Insure that there is a clearance of a minimum of $.010''$ between Head Load Bail and Head Load Arm.
- j. Replace side cover.

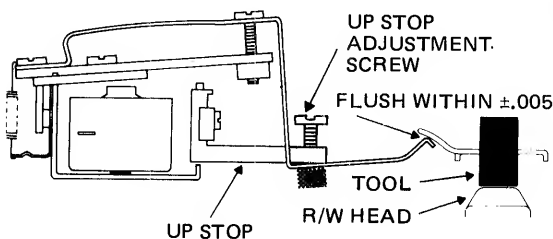


FIGURE 5 HEAD LOAD ACTUATOR UPSTOP ADJUSTMENT

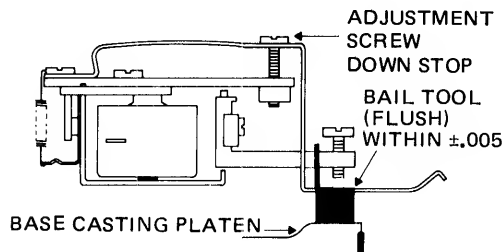


FIGURE 6 HEAD LOAD ACTUATOR DOWN STOP ADJUSTMENT

3.4.6.4 Head Load Actuator Timing

- a. Insert Alignment Diskette (SA120).
- b. Step carriage to Track 0.
- c. Sync oscilloscope on TP11 (- Load Head). Set time base to 10MSEC/division.
- d. Connect one probe to TP1 and the other to TP2. Ground probes to the PCB. Set the inputs to Add and invert one input.
- e. Energize the Head Load solenoid and observe the read signal on the oscilloscope. The signal must be at 50% of full amplitude by 50Msec. Reference Figure 7.
- f. If this is not met, continue on with the procedure.
- g. Check adjustments outlined in paragraph 3.4.6.2 or 3.4.6.3.
- h. If item 'g' is ok, adjust down stop screw (Figure 6) CW until timing is met. Note, not to exceed $\frac{1}{4}$ turn.

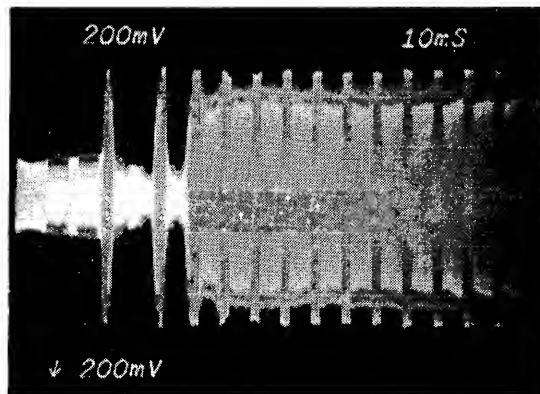


FIGURE 7 HEAD LOAD ACTUATOR TIMING

3.4.7 Index/Sector Photo Transistor Assembly

3.4.7.1 Index/Sector Photo Transistor Assembly: Removal and Installation

- a. Disconnect P2 connector from PCB.
- b. Remove wires from Door Closed switch and extract wires from P2 connector pin 9 (L9) Black, H (R7) Brown, 6 (L6) Red and B (R2) Orange.
- c. Remove cable clamp holding wires from detector.
- d. Remove screw holding detector to the base plate and remove assembly.
- e. To install reverse procedure. If replacing old style phototransistor assembly with new style (potentiometer on assembly), use Field Kit P/N 50928.

3.4.7.2 Index/Sector Photo Transistor Potentiometer Adjustment

- a. Insert Alignment Diskette (SA120).
- b. Using oscilloscope monitor TP-12 (-Index), sync internal negative, DC coupled, set vertical scale to 2 V/cm.
- c. Adjust the potentiometer on the Sector/Index Phototransistor to obtain a pulse of 1.7 msec. $\pm .5$ msec. duration.
- d. Continue adjustment in section 3.4.7.3.

3.4.7.3 Index/Sector Adjustment

- a. Insert Alignment Diskette (SA120).
- b. Step carriage to Track 1.
- c. Sync oscilloscope on TP 12 (- Index). Set time base to 50 μ sec/division.
- d. Connect one probe to TP 1 and the other to TP 2. Ground probes to the PCB. Set the inputs to AC, Add and invert one channel. Set vertical deflection to 500 MV/division.
- e. Channels 1 and 2 should be added and one of the channels inverted.

- f. Observe the timing between the start of the sweep and the first data pulse. This should be $200 \pm 100 \mu\text{sec}$. If the timing is not within tolerance, continue on with the adjustment. Reference Figure 8.
- g. Loosen the holding screw in the Index Transducer until the Transducer is just able to be moved.
- h. Observing the timing, adjust the Transducer until the timing is $200 \pm 50 \mu\text{sec}$. Insure that the Transducer Assembly is against the registration surface on the base casting.
- i. Tighten the holding screw.
- j. Recheck the timing.
- k. Seek to Track 76 and reverify that the timing is $200 \pm 100 \mu\text{sec}$.

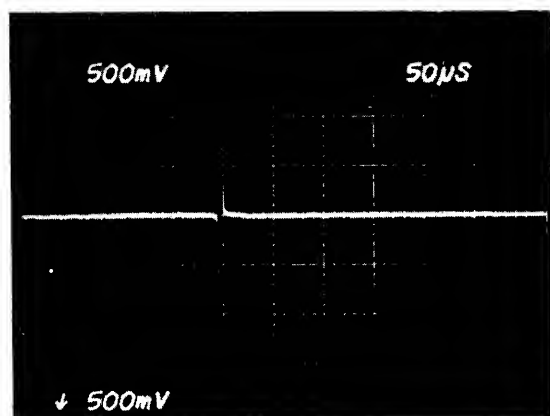


FIGURE 8 INDEX TIMING

3.4.8 Spindle Assembly

- a. Remove side cover (Section 3.4.2).
- b. Swing out cartridge guide (Section 3.4.3).
- c. Remove the nut and washer holding the spindle pulley. Use spanner wrench, P/N 50572, to hold spindle.
CAUTION: The pre-loaded rear bearing may fly out when spindle pulley is removed.
- d. Withdraw spindle hub from opposite side of baseplate.
- e. Reverse the procedure for installation.
- f. Tighten nut to 20 in./lbs.

3.4.9 Cartridge Guide

3.4.9.1 Cartridge Guide Removal

- a. Perform steps 3.4.3 through 3.4.6.

- b. Pull up on the upper pivot cap screw until the shoulder contacts the base casting. Push up on the cartridge guide until the lower pivot clears the casting.

NOTE: On some units a 'C' clip will have to be removed in place of lifting pivot screw. Figure 9.

- c. Tilt the cartridge guide slightly, and remove it from the upper pivot.
- d. To install the cartridge guide, reverse the procedure.

NOTE: When swinging cartridge guide in, insert a small screwdriver through the access slot and load the torsion spring. (Force the torsion spring roller toward the rear of the spring.)

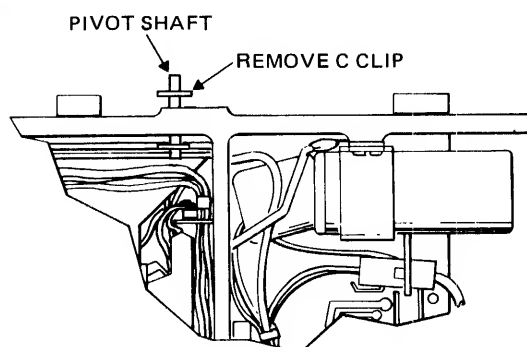


FIGURE 9 CARTRIDGE GUIDE REMOVAL

3.4.9.2 Cartridge Guide Adjustment

- a. Insert the shoulder screw (tool p/n 50377) through the adjustment hole in the cartridge guide and screw completely into the base casting (hand tight). Reference Figure 10.
NOTE: Starting with drives manufactured in Dec. '73 the base casting has been machined in the adjustment hole area. This can be easily seen. On the machined castings the long shoulder (#2) should be used. On files where the casting was not machined the short shoulder (#1) should be used.
- b. Move the handle into the latched position and hold it lightly against the latch.
- c. Tighten two screws holding the cartridge guide to the latch plate.

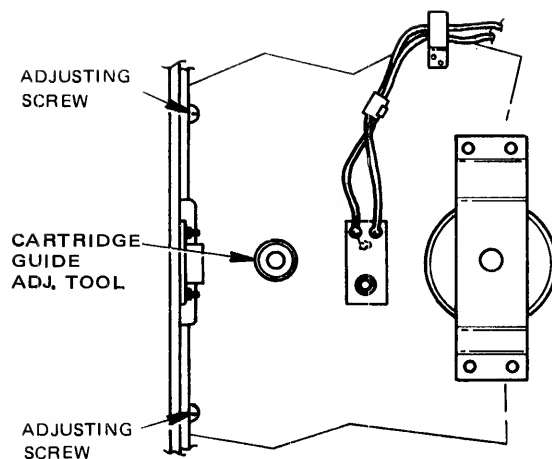


FIGURE 10 CARTRIDGE GUIDE ADJUSTMENT

- d. Remove the tool and check to determine the flange on the clamp hub clears the cartridge guide when the spindle is rotating. If the clamp hub rubs on the cartridge guide, repeat the adjustment procedure.
- e. Check index alignment per Section 3.4.7.3.
- f. Insert diskette, close and open door, then check for proper operation.

3.4.10 Front Plate Assembly: Removal

- a. Remove side cover (Section 3.4.2).
- b. Swing out the cartridge guide assembly (Section 3.4.3).
- c. Remove 4 screws holding the front plate assembly to the base casting.
- d. Reverse the procedure for installation.
- e. Insert the cartridge guide assembly per Sections 3.4.9.1 and .2.

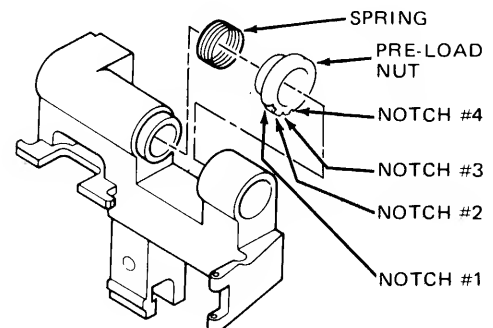
3.4.11 Stepper/Carriage

3.4.11.1 Stepper/Carriage Assembly: Removal and Installation

- a. Disconnect the connectors from PCB and remove PCB.
- b. Remove cable clamp holding R/W head cable.
- c. Remove side cover (Section 3.4.2).
- d. Swing out cartridge guide (Section 3.4.3).
- e. Extract stepper cable contacts from P2 connector. Black 10 (L10), Red 2 (L2), Brown 5 (L5), and Orange 8 (8). Note: This step is only necessary if the stepper motor is to be replaced.
- f. Loosen (3) motor clamp screws and rotate clamps to allow withdrawal of motor. On new production units, with redesigned stepper mounting clamp, loosen (2) screws and swing clamp down to allow withdrawal of motor.

CAUTION: DO NOT LOOSEN THREE SCREWS COATED WITH GLYPTOL.

- g. Remove cable clamp and spacer holding R/W head cable on cartridge guide side of unit. On new production units a grommet on the cable is inserted into a slot on the Track 0 Detector bracket.
- h. To install stepper/carriage assembly reverse procedure. Note steps "i" and "j".
- i. If installing a new carriage, set the pre-load nut in the #3 notch. Reference figure 11.
- j. When threading lead screw into carriage assembly, press the pre-load nut slightly against spring in order to start thread. After threading, insure there is a gap between pre-load nut and rear of carriage.
- k. Adjust index (Section 3.4, 7.3).
- l. Adjust radial head alignment (Section 3.4.11.2).
- m. Adjust Track 0 stop (Section 3.4.11.7/.8).
- n. Adjust Track 0 flag (Section 3.4.11.9).



3.4.11.2 Head Radial Alignment

NOTE: Head radial alignment should be checked prior to adjusting index/sector, Track 00 flag or carriage stop.

- a. Load alignment diskette (SA120). (Note: Alignment diskette should be at room conditions for at least twenty minutes before alignment.)
- b. Step the carriage to Track 38.
- c. Sync the oscilloscope on TP 12 (-CE Index). Set the time base to 20 Msec per division. This will display over one revolution.
- d. Connect one probe to TP 1 and the other to TP 2. Ground the probes on the PCB. Set the inputs to AC, Add and invert one channel. Set the vertical deflection to 200 MV/dev.

e. The two lobes must be within 70% amplitude of each other. If the lobes do not fall within the specification, continue on with the procedure. Reference Figure 12.

f. Loosen the three mounting screws which hold the motor to the mounting plate.

CAUTION: DO NOT LOOSEN THREE SCREWS COATED WITH GLYPTOL.

g. Rotate the stepper motor to radially move the head in or out. If the left lobe is less than 70% of the right, turn the stepper motor ccw as viewed from the rear. If the right lobe is less than 70% of the left lobe, turn the stepper motor clockwise as viewed from the rear.

h. When the lobes are of equal amplitude, tighten the motor mounting screws. Reference Fig. 12.

i. Check the adjustment by stepping off track and returning. Check in both directions.

j. Whenever the Head Radial Alignment has been adjusted, the Track 00 detector adjustment (Section 3.4.11.9) and Track 00 stop must be checked (Section 3.4.11.8)

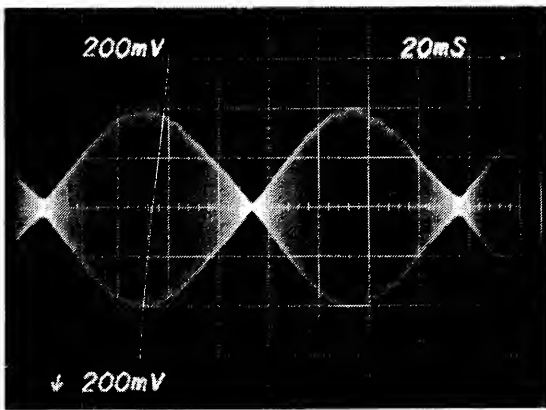


FIGURE 12 HEAD RADIAL ALIGNMENT

3.4.11.3 Read/Write Head Button: Removal and Installation

- Remove side cover.
- To remove the old button if glued on metal arm, open the arm, grasp the button with a pair of pliers and rotate the button. This breaks loose the button, and the button can be removed. Remove any glue that may remain by scraping.
- To remove the old button on metal arm, if attached with a clip and washer, grasp the button with pliers and rock the button back and forth while pulling clip off with your finger.

d. To remove the old button on molded plastic arm, hold the arm out away from head, squeeze the locking tabs together with a pair of needle nose pliers and press forward.

e. To install load button on metal arm, place the new button on the arm. On the back of the arm place the rubber grommet. Holding the button, push the clip over the plastic stud until it is tight against the rubber grommet. Reference Figure 13.

f. To install load button on molded plastic arm, press the button into the arm, from the head side, and it will snap in place.

g. Adjust according to Section 3.4.11.4.

NOTE: The load arm should never be opened over 90° from carriage assembly to prevent possible damage to torsion spring.

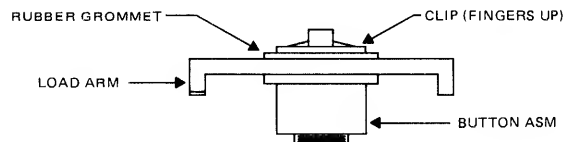


FIGURE 13

3.4.11.4 Read/Write Head Load Button Adjustment

- Insert Alignment Diskette (SA120).
- Connect oscilloscope to TP 1 and 2, added differentially and sync negative external on TP 12 (-INDEX)
- Step carriage to Track 75.
- Observing read signal on oscilloscope, rotate the load button CCW in small increments (10°) until maximum amplitude is obtained.

3.4.11.5 Head Penetration Adjustment

NOTE: This adjustment is not normally done in the field. The only time that this adjustment need be done is when the stepper mounting plate has been loosened or removed.

- Place the penetration tool (P/N 50380) on the gauge block and insure that the gauge reads .03 (3 on the small hand) and zero the dial for the large hand. This results in a reading of .030".
- Swing open the cartridge as per Section 3.4.3.
- Place the penetration tool on the base assembly with the short leg on the platen, the long leg on the carriage guide bar, and the plastic tip in the center of the R/W head.

- d. The head penetration should be $.030'' \pm .003''$ read on the gage.
- e. If the head does not meet this adjustment, move the stepper plate laterally until the gage reads $.030''$.
- f. Tighten the screws and recheck the adjustment.
- g. Return cartridge guide and adjust as per Section 3.4.9.2.

3.4.11.6 Track 0 Detector: Removal and Installation

- a. Remove side cover (Section 3.4.2).
- b. Swing carriage guide open (Section 3.4.3).

- c. Manually rotate stepper shaft and move carriage all the way in.
- d. Remove 2 screws holding bracket to base casting and remove bracket and detector.
- e. Remove PCB connector and remove PCB.
- f. Extract cable from P2 connector; Brown, A (R1); Black, C (R3); Red, F (R6); and Orange K (R9).
- g. Remove cable clamps and remove Detector assembly.
- h. To install, reverse the procedure.
- i. Adjust according to Section 3.4.11.9.

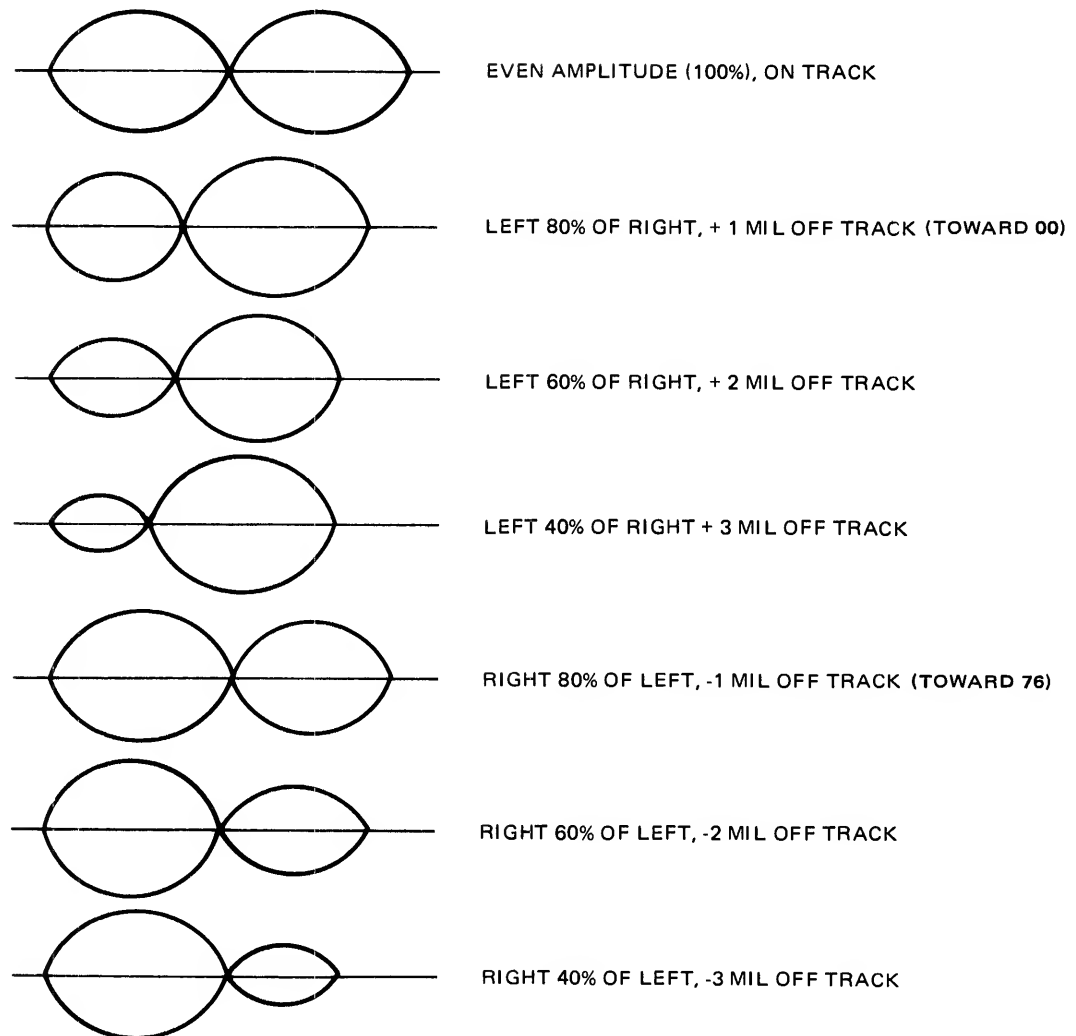


Figure 14 R/W Head Radial Alignment

3.4.11.8 Track 00 Stop Adjustment (Old Style)

- a. Remove side cover (Section 3.4.2).
- b. Step carriage to Track 00. Verify that carriage is at 00 by checking P1L12 is minus (ground).
- c. Check that stop is .005" (+.005" –.000") clearance between the carriage and the stop.
- d. If clearance is not within tolerance, continue on with the adjustment procedure.
- e. Loosen the screw in the Track 00 stop.
- f. Place a .005" feeler gage between the carriage and the stop. Position the stop against the feeler gage. Tighten the stop screw.
- g. Turn off AC and DC power.
- h. Manually rotate the lead screw clockwise to insure no interference between the carriage and the stop screw.
- i. If interference occurs, loosen screw and rotate stop to avoid the interference.
- j. Replace side cover.

3.4.11.8 Track 00 Stop Adjustment (new style)

- a. Remove side cover (Section 3.4.2)
- b. Step carriage to Track 00. Verify that carriage is at 00 by checking P1L12 is minus (ground).
- c. Check that stop is .030" \pm .020" between collar and carriage. Turn DC power OFF, and manually rotate lead screw CW until carriage stops. Check that stop is .020" \pm .010" between collar and carriage.
- d. If clearances are not within tolerance, continue on with adjustment procedure.
- e. Turn DC power ON.
- f. Step carriage to Track 02.
- g. Loosen Track 00 stop collar.
- h. Grasp end of lead screw in back of stepper motor, with a pair of pliers and manually turn lead screw CW to the Track –01 position. (Next detent position on stepper motor.)
- i. Position the stop collar axially along the lead screw so there is .020" \pm .010" between collar and carriage. Rotate the collar toward inside until the stop on the collar contacts the carriage stop surface. Tighten screw.
- j. Turn DC Power OFF and back ON. Carriage should move to Track 00. Verify that there is data at Track 00.

- k. Step carriage between Track 00 and 76 and check for any binding or interference between the carriage, lead screw, stop and head cable.

3.4.11.9 Track 00 Flag Adjustment

- a. Remove side cover (Section 3.4.2).
- b. Check head radial alignment and adjust if necessary before making this adjustment.
- c. Connect oscilloscope probe to TP 26. Set vertical deflection to 1 v/division and sweep to continuous.
- d. Step carriage to Track 01. TP 26 should be high (+5 volts).
- e. If TP 26 is not high, loosen screw on Track 0 flag and rotate flag counter clockwise until TP 26 just goes high.
- f. Step carriage to Track 2. TP 26 should go low. Adjust flag clockwise if not low.
- g. Check adjustment by stepping carriage in and returning Track 00, observing that TP 26 is low at Track 02 and high at Tracks 01 and 00.
- h. Replace side cover.

3.5 SA902 MAINTENANCE

Maintenance procedures of the SA902 are the same as those outlined in Section 3.4 of this manual. The only special requirement is that the drives may have to be split apart to gain access to components located between drives. This section of the Maintenance Manual describes the procedure for splitting the units apart.

3.5.1 Special Tools

The following special tools are required for maintenance of the SA902 if the units are to be operated while in the split position.

P/N	Description
50464-0	Extended Maintenance Belt
50466-0	Head Cable Extender
50467-0	Drive Cable Extender

3.5.2 Separating Units

- a. Remove plate (loosen 4 screws) from bottom holding units together if present.
- b. Remove drive belt from right hand motor pulley and place it on hook provided. Reference Figure 15.
- c. Attach Head Extender Cable (P/N 50466-0) to right hand drive R/W head pigtail (P-5). Insure polarity of cables are matched properly. Reference Figure 16.

- d. Raise latches (2) at the front of the machine, top and bottom. Screws may have to be loosened. Reference Figure 17.
- e. Move right hand drive out and secure into the service position with latch and bracket on top of units. Reference Figure 18. While moving drives apart route right hand R/W head pigtail through left hand drive.
- f. Remove P2 from PCB and attach Drive Cable Extender (P/N 50467-0) to it and PCB. Reference Figure 19.
- g. Remove drive belt from right drive spindle pulley and hook. Install Extended Maintenance Belt (P/N 50464-0) to right drive and motor pulley.
- h. Units are now ready to operate in the split position. Reference Figure 20.
- i. To rejoin units reverse procedure. To reinstall right hand drive spindle belt, place belt on spindle pulley and hook provided. Reference Figure 15.

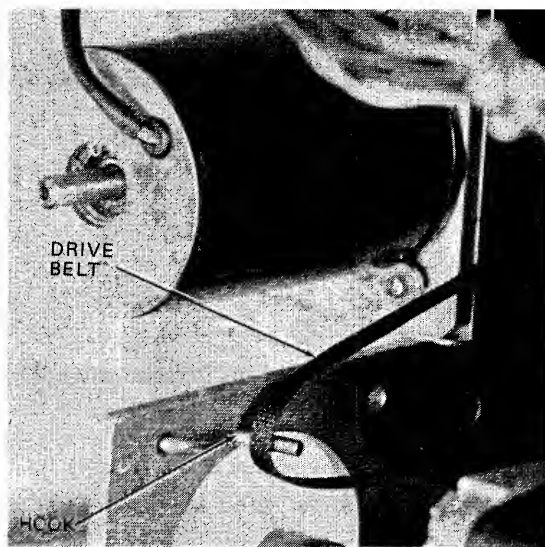


FIGURE 15 RIGHT DRIVE BELT REMOVAL

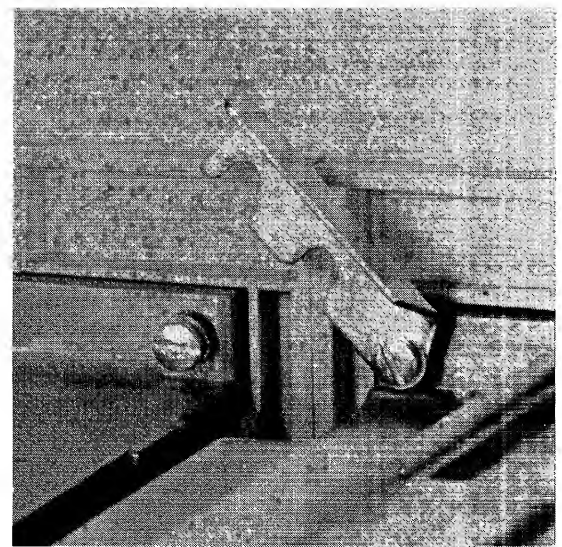


FIGURE 17 LATCH

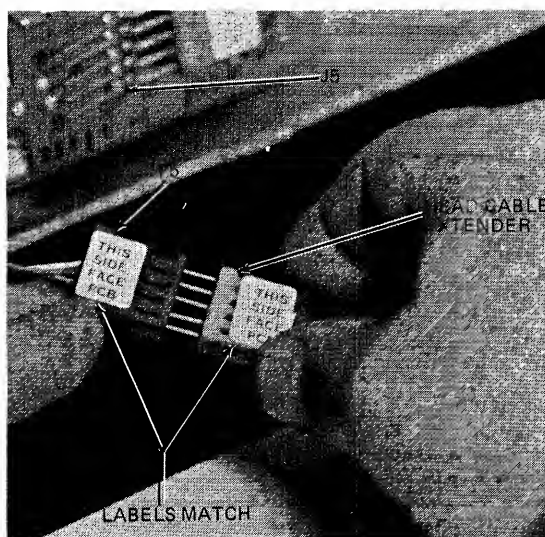


FIGURE 16 HEAD CABLE EXTENDER

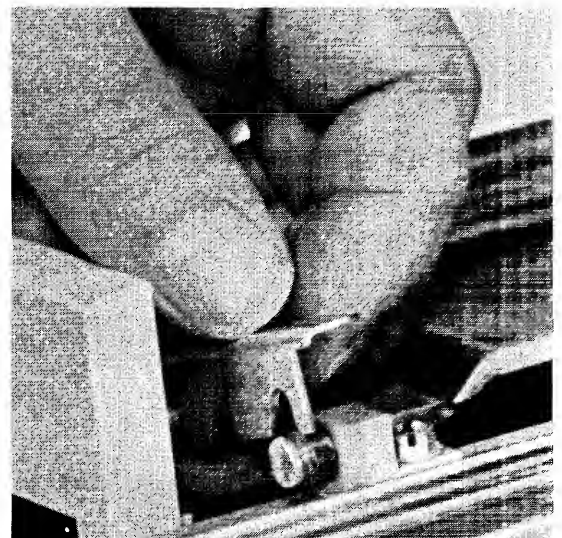


FIGURE 18 LATCHING UNITS TOGETHER

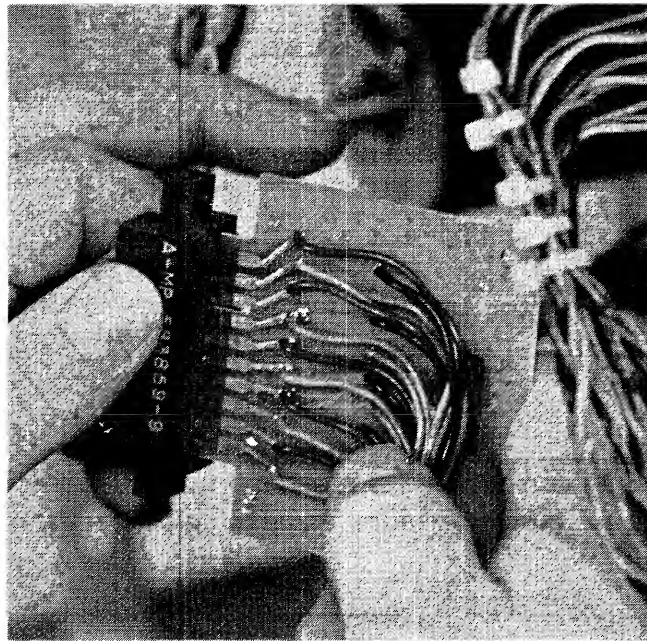


FIGURE 19 DRIVE EXTENDER CABLE ATTACHMENT

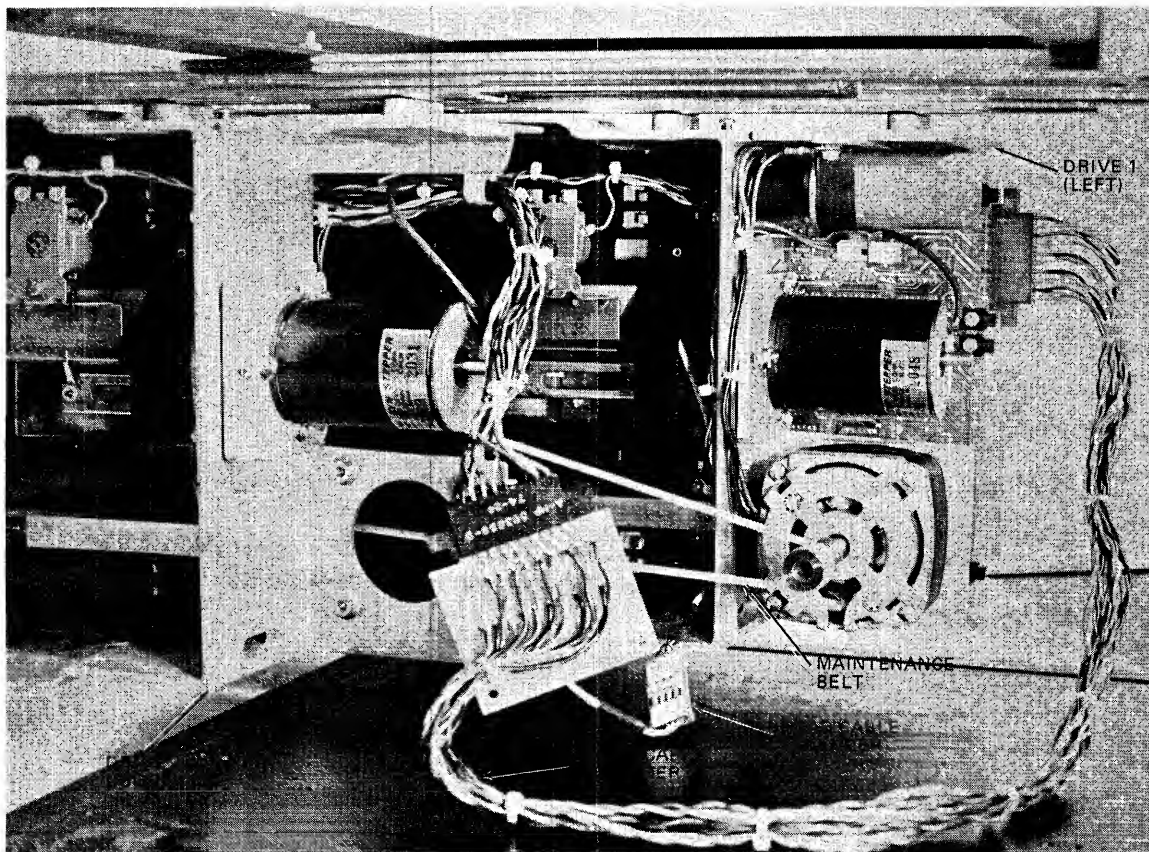
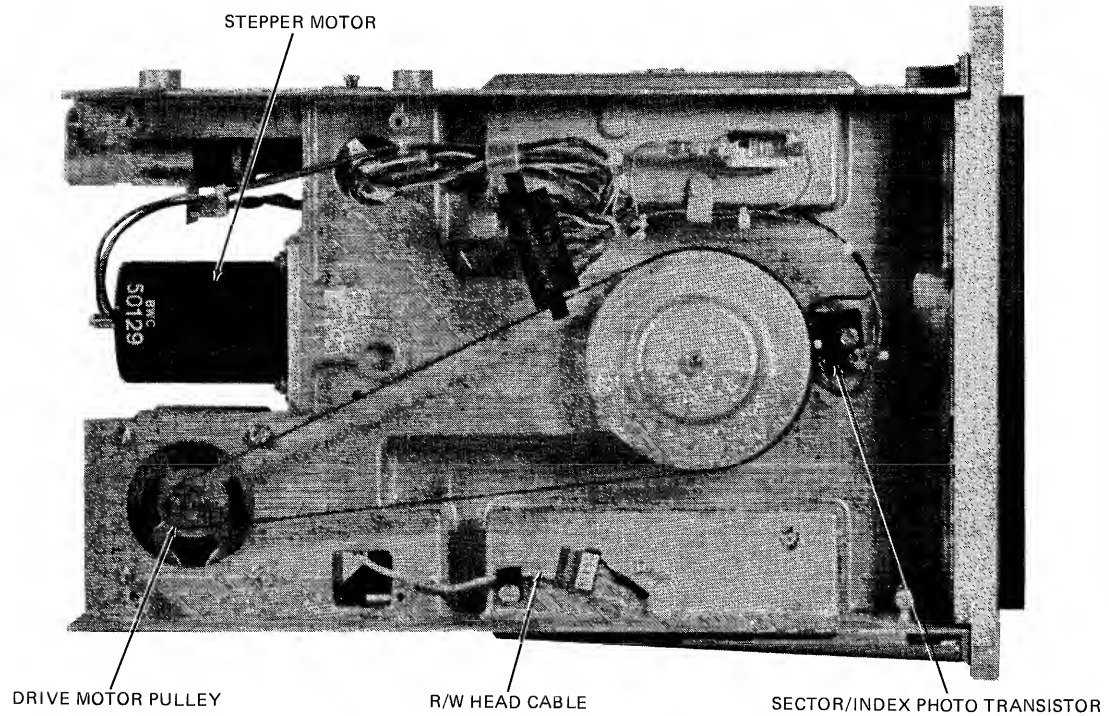
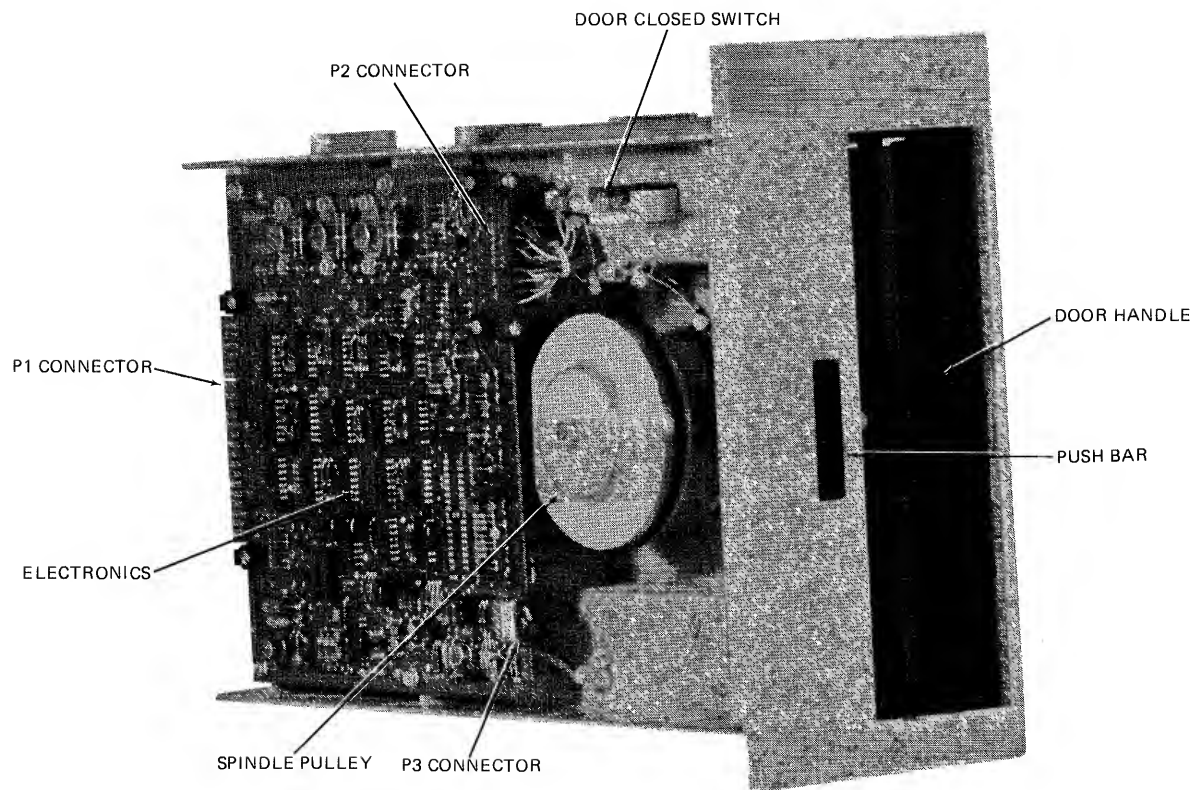
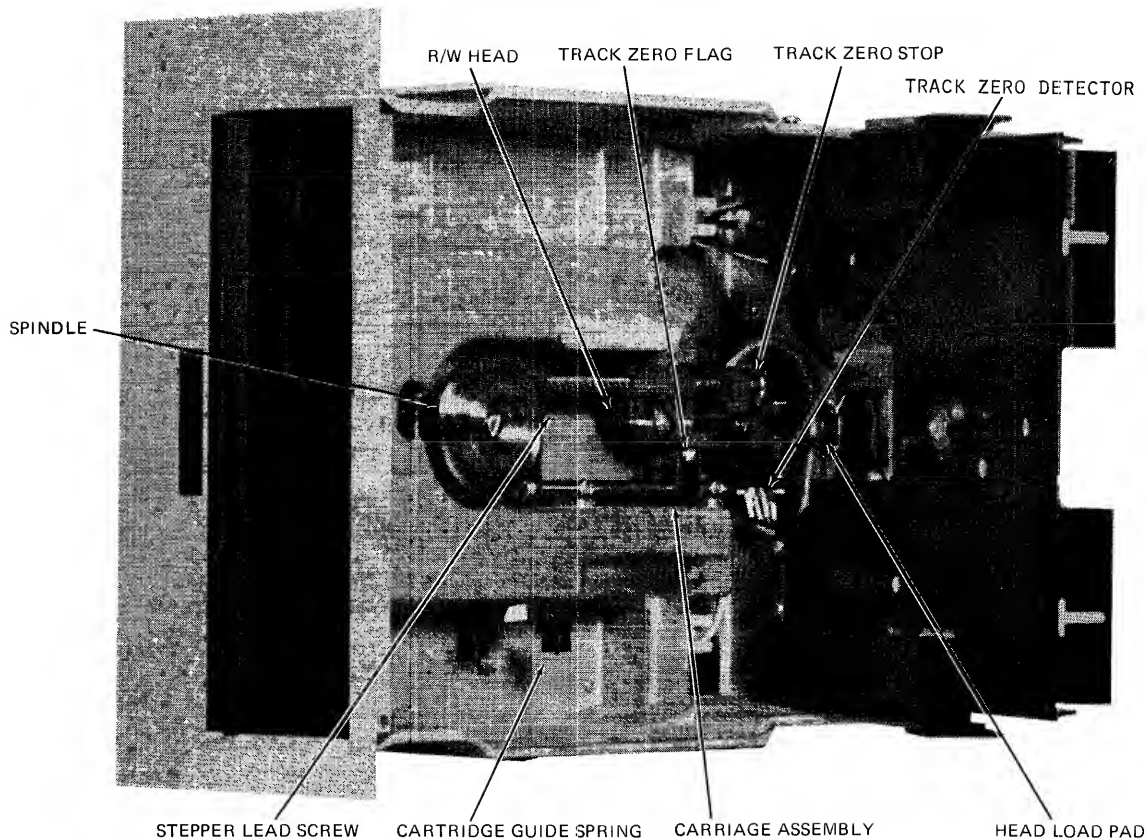
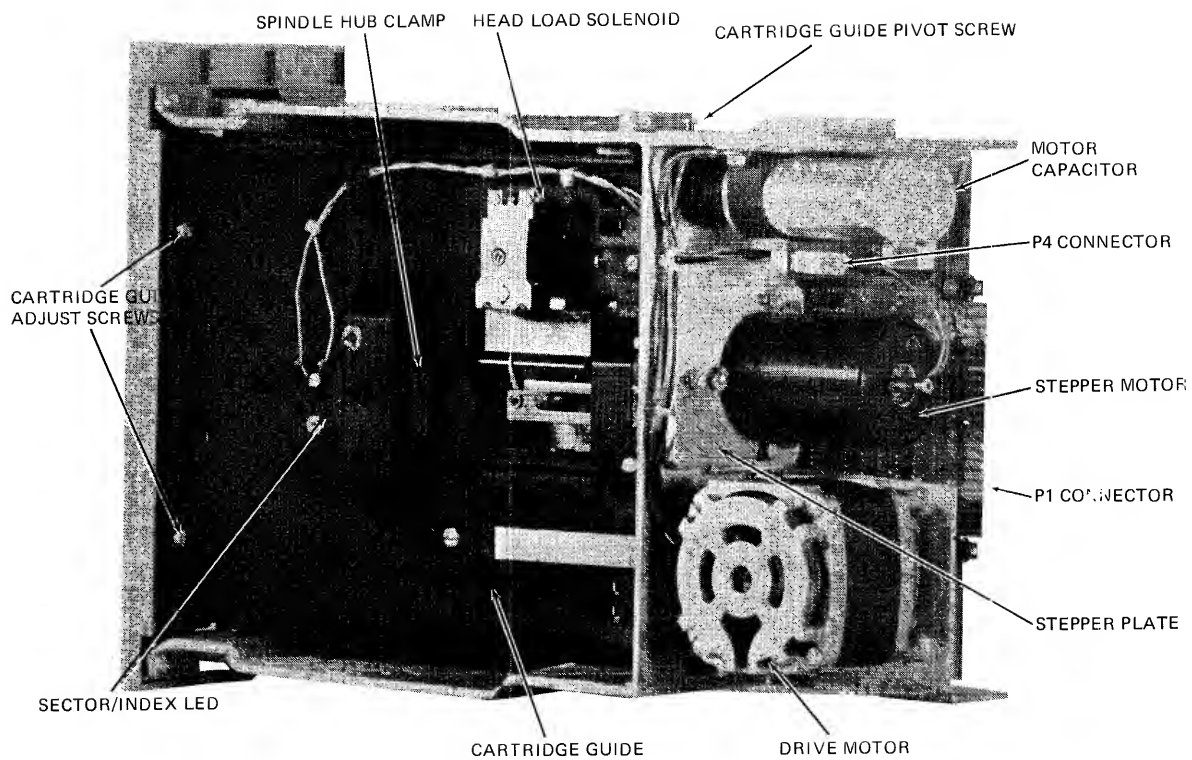


FIGURE 20 OPERATING IN THE MAINTENANCE POSITION

3.6 PHYSICAL LOCATIONS





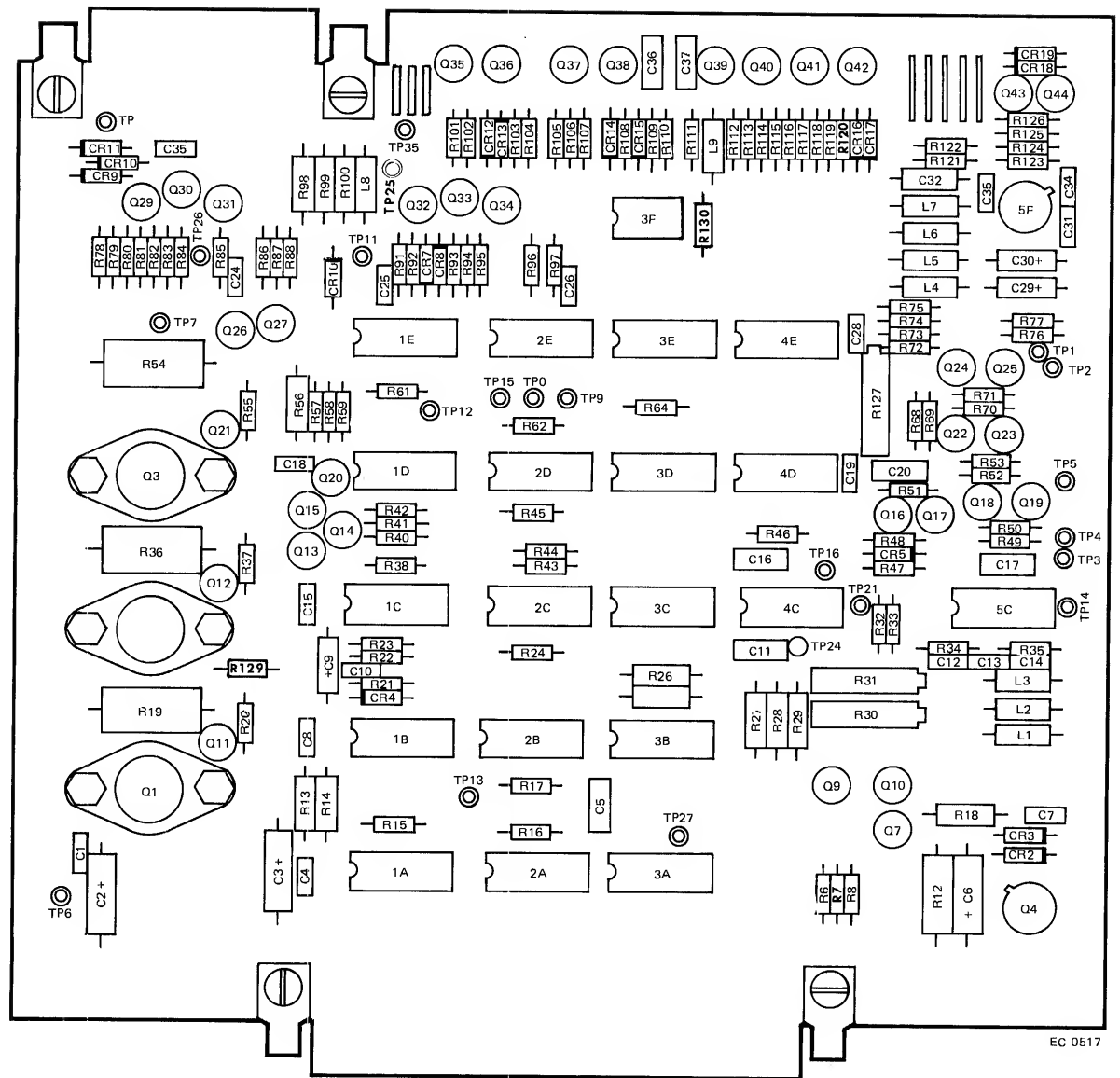
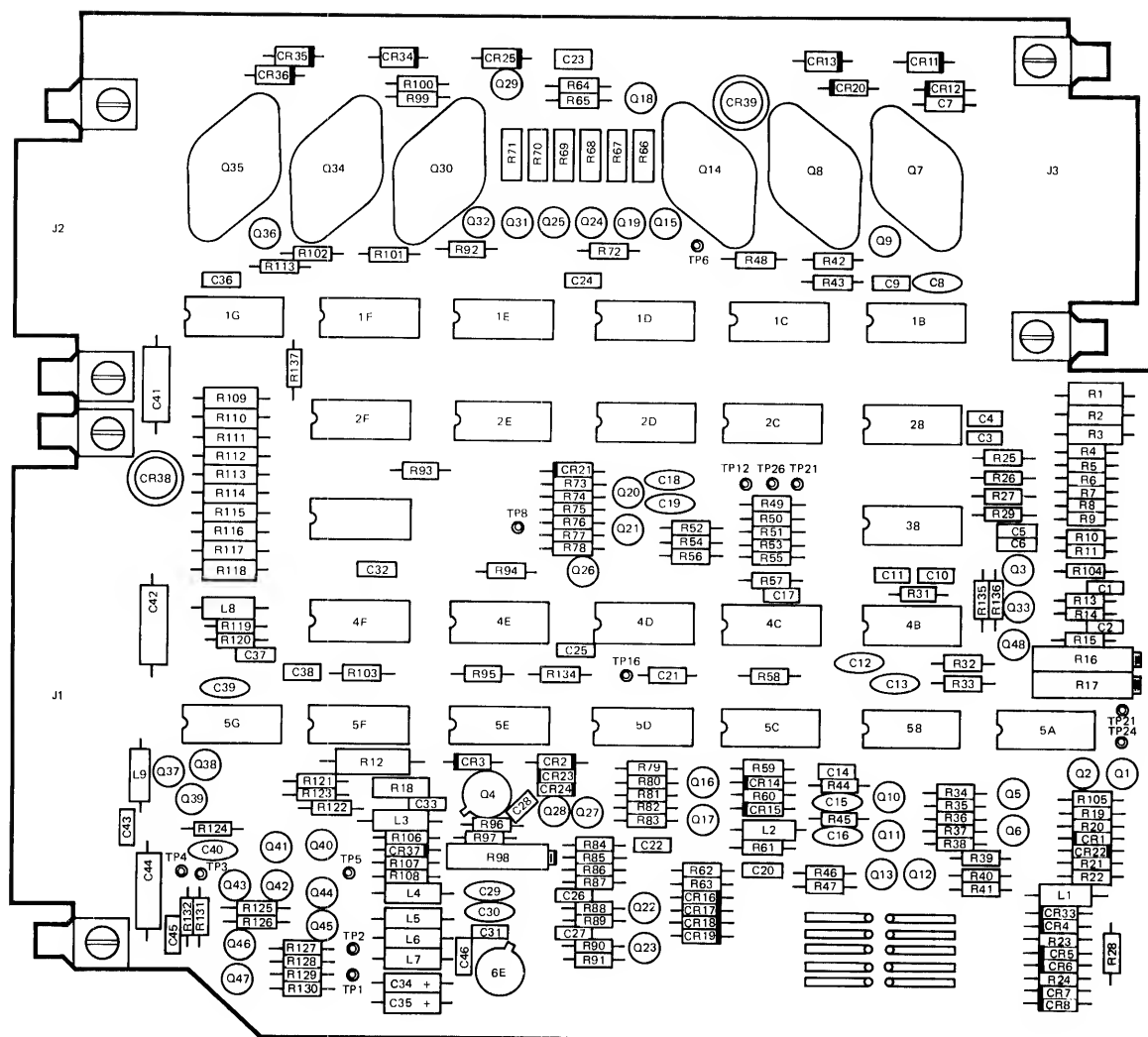


Figure 21 SA900/901 Component Locations



PART NO
50501-0

900 LOGIC MANUAL SN

INDEX

AA001	INDEX
AB010	FUNCTIONAL DIAGRAM
DA010	READ/WRITE/INOP CKTRY
DA020	STEPPER CONTROL
DA030	DETECTORS
DA040	MOTORS/SOLENOID/SWITCH
VA010	INTERFACE INPUT (J1, J4, AND J5)
VA020	INTERFACE OUTPUT (J1)

TABLE I
OPTIONAL
FEATURES

PCB ASM NO.	OPTIONAL FEATURES			
	-5V	-12V TO -15V	DATA SEP	SECTOR SEP
25002	X			
25003		X		
25004	X		X	
25005		X	X	
25006	X		X	X
25007		X	X	X

WRITE PROTECT CAN BE ORDERED WITH
ANY OF THE ABOVE.TABLE IIICUSTOMER CUT TRACE OPTIONS AND HISTORY CHART
JUMPER AND TRACE CUT CAPABILITY

DESIGNATOR	DESCRIPTION	OPEN	SHORT
A	DRIVE SELECT I OR HEAD LOAD	<input type="checkbox"/>	<input type="checkbox"/>
B	ALTERNATE DRIVE SELECT PATH	<input type="checkbox"/>	
C	RADIAL HEAD LOAD		<input type="checkbox"/>
D	DRIVE SELECT TERMINATION WITH RADIAL HEAD LOAD	<input type="checkbox"/>	
E	MULTIPLEX OR DRIVE SELECT FEATURE	<input type="checkbox"/>	
F	TERMINATION FOR "WRITE DATA"		<input type="checkbox"/>
G	TERMINATION FOR "FILE INOP RESET"		<input type="checkbox"/>
H	TERMINATION FOR "WRITE GATE"		<input type="checkbox"/>
J	TERMINATION FOR "DIRECTION SELECT"		<input type="checkbox"/>
K	TERMINATION FOR "STEP"		<input type="checkbox"/>
M	RADIAL/READY INTERRUPT		<input type="checkbox"/>
R	STEP WITH HEAD UNLOADED		<input type="checkbox"/>
S	R.P.S. (RADIAL SECTOR AND INDEX)		<input type="checkbox"/>
X	DRIVE SELECT INDEPENDENT OF HEAD LOAD	<input type="checkbox"/>	
Y	DRIVE SELECT INDEPENDENT OF HEAD LOAD		<input type="checkbox"/>
DS	STEPPER POWER FROM DRIVE SELECT	<input type="checkbox"/>	

TABLE II

FACTORY CUT TRACE OPTIONS

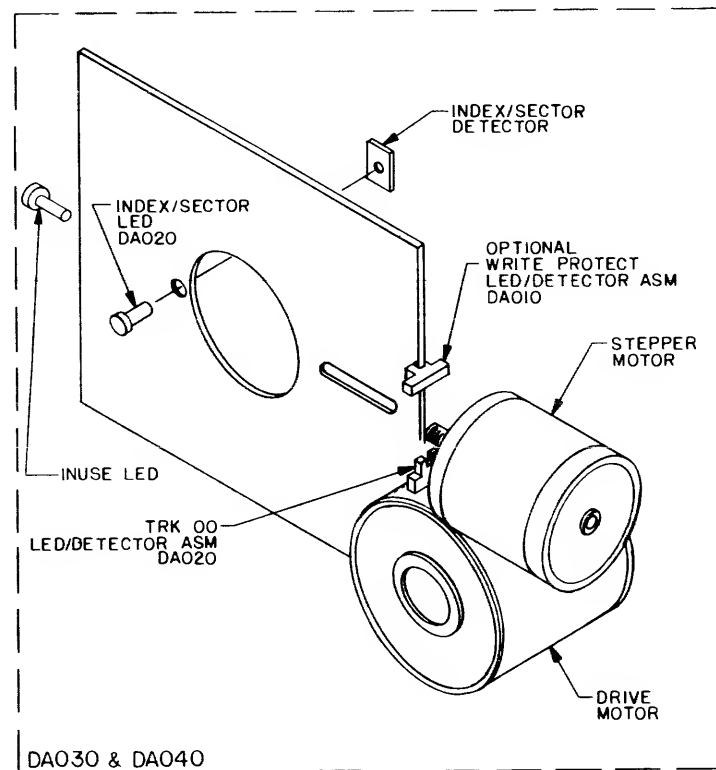
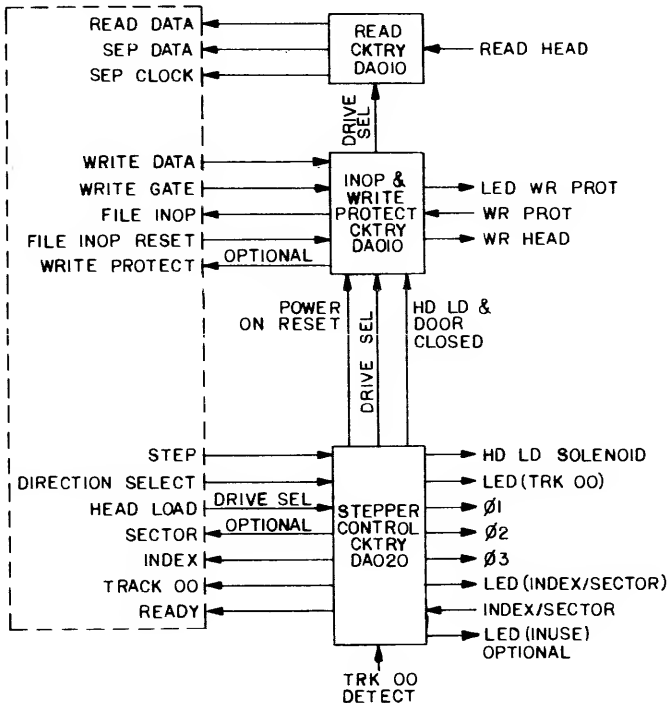
PCB ASM NO.	TRACE "L"	TRACE "N"	TRACE "P"
25002	SHORTED	OPEN	SHORTED
25003	OPEN		
25004	SHORTED		
25005	OPEN	OPEN	SHORTED
25006	SHORTED	SHORTED	OPEN
25007	OPEN	SHORTED	OPEN

☐ AS SHIPPED FROM FACTORY

FACTORY CUT TRACE OPTIONS AND HISTORY CHART

L	-5 OR -12 TO -15V	SEE TABLE II
N	INDEX ONLY (900)	SEE TABLE II
P	INDEX AND SECTOR (901)	SEE TABLE II

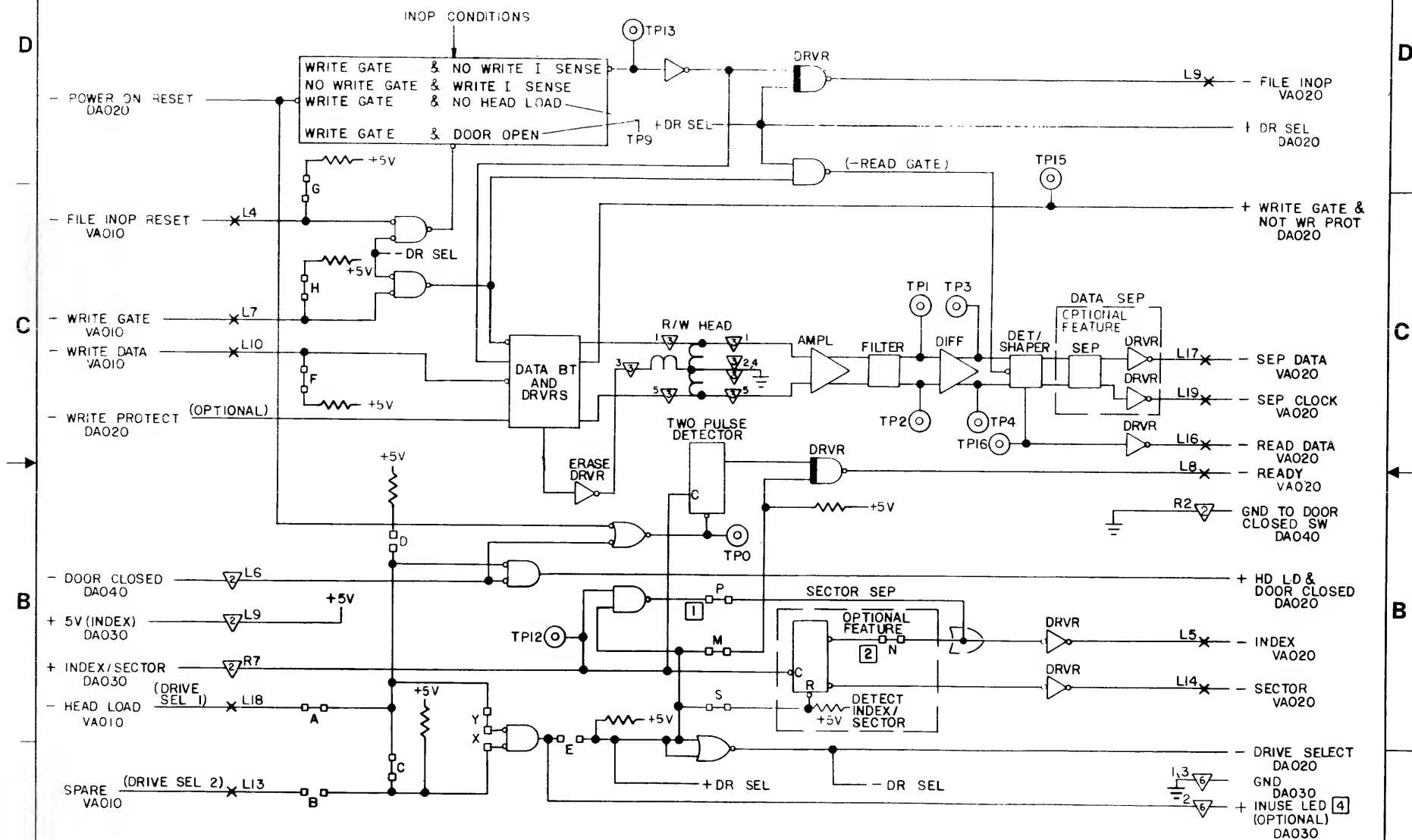
MUST CONFORM TO ENGINEERING SPEC. ES 30000-0		EC HISTORY		SHOULART USE	
MATERIAL	TOLERANCE UNLESS OTHERWISE NOTED	DATE	NO.	TITLE	
		3-16-4	0114	LOGIC MANUAL INDEX	
CASE DEPTH	LINEAR ± XX	7-23-4	0274	DETAIL DESIGN	JUL 16 3/74
HARDNESS	± XXX	JAN 76	0485	APPRO	RELEASED FOR ASSEMBLY
SURFACE TREATMENT	ES			C	50500
	CORNERS BROKEN	OUTSIDE	MAX	SCALE	3/16
	INSIDE	MAX		DOC CODE	OD
				PART NO	50501-0
				REV	0485

INTERFACE (P1 & P4)
VA010 & VA020

ABOIO

MUST CONFORM TO ENGINEERING SPEC. ES 30000-0				EC HISTORY		SHUGART ASSOCIATES			
MATERIAL	TOLERANCE UNLESS OTHERWISE NOTED			DATE	NO.	TITLE			
	LINEAR ± .XX			3-16-4	0114	LOGIC DIAGRAM			
CASE DEPTH	± .XXX			JAN 76	0485	FUNCTIONAL DIAGRAM			
HARDNESS	ANGULAR ±					DETAIL	Inde 3 174	RELEASED FOR ASSEMBLY	
SURFACE TREATMENT	ES					DESIGN		50500	
	CORNERS EDGES BROKEN					APPRO		SHEET 1 OF 1	
	OUTSIDE MAX					SCALE		PART NO	
	INSIDE MAX					DOC CODE	OD	50502-0	
								REV/EC	
								0485	

50503-0

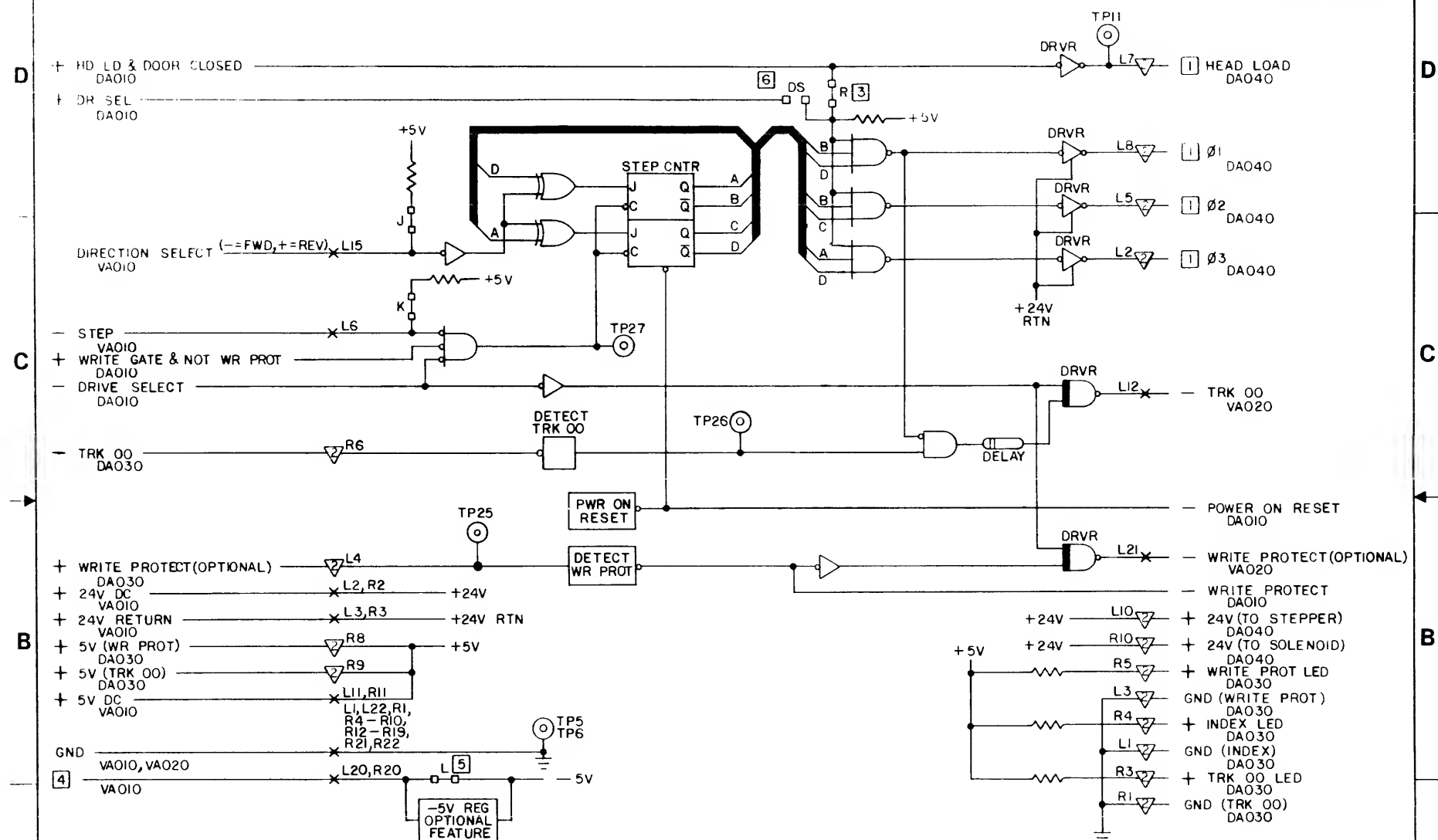


NOTES:

- 1 CUT TRACE (P) FOR 901. SEE PAGE AA001, TABLE II.
- 2 CUT TRACE (N) FOR 900. SEE PAGE AA001, TABLE II.
3. CONNECTOR SYMBOL REFERENCE: X=J1, Y=J2, Z=J3, V=J6.
- 4 GROUND WHEN INACTIVE AND 1.5VDC WHEN ACTIVE.

MUST CONFORM TO ENGINEERING SPEC ES 30000-0		EC HISTORY		SHUGART ASSOCIATE	
MATERIAL		DATE	NO	TITLE	
	TOLERANCE UNLESS OTHERWISE NOTED	3-16-4	0114	LOGIC DIAGRAM	
	LINEAR ± XX	1-23-4	0274	READ/WRITE/INOP CKTRY	
	ANGULAR ± XXX	JAN 76	0485	DETAIL	3/74
CASE DEPTH				DESIGN	50500
HARDNESS				APPRO	3/74
SURFACE TREATMENT				SCALE	0D
	CORNERS EDGES RICKEN			SHEET	OF 1
	OUTSIDE MAX			REV NO	50503-0
	INSIDE MAX			REV EC	0485

DAO10



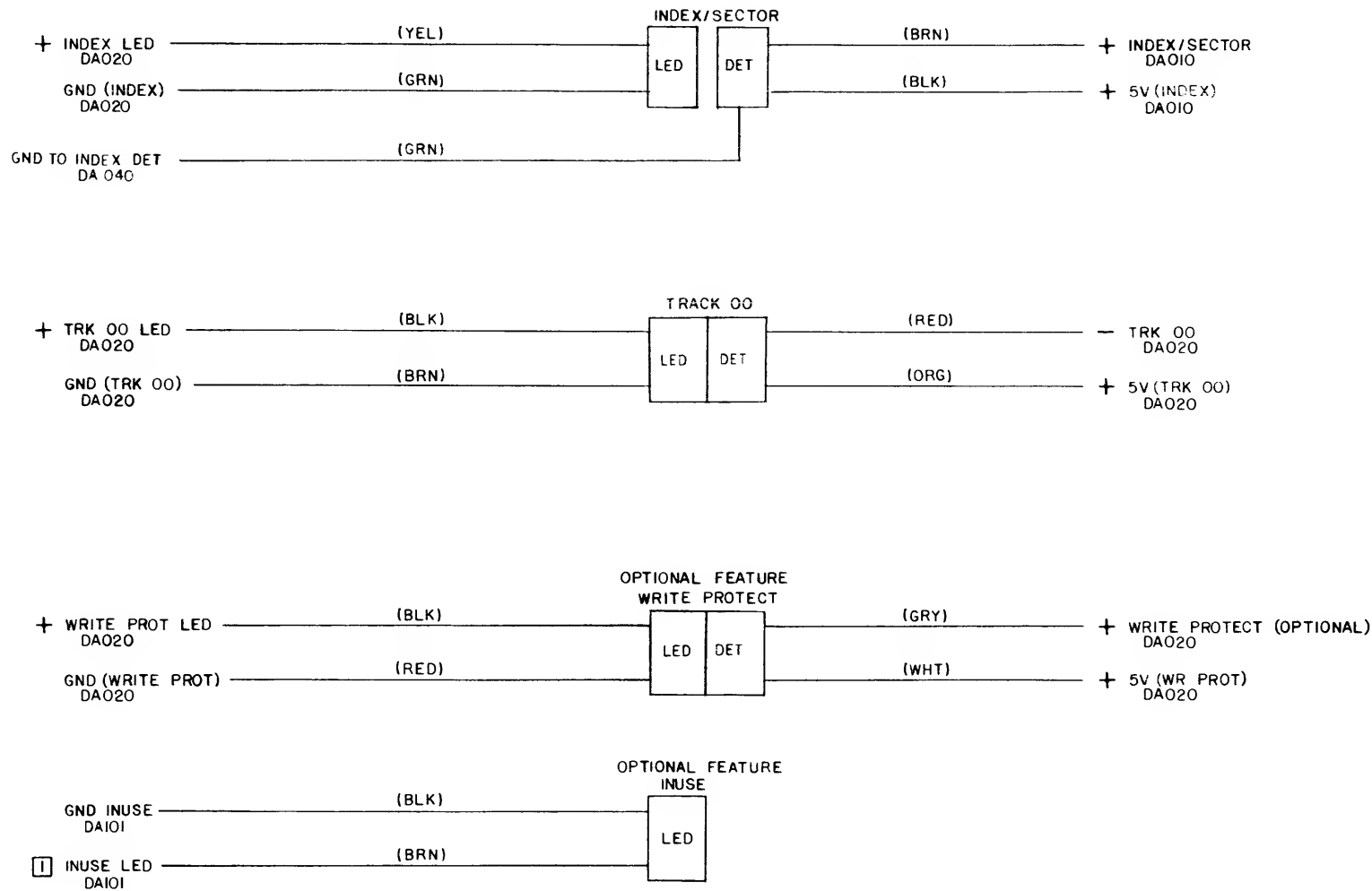
NOTES:

- 1 GND WHEN ACTIVE & + 24VDC WHEN INACTIVE.
2. CONNECTOR SYMBOL REFERENCE: X=J1, ▽=J2
- 3 CUT TRACE(R) TO ALLOW STEPPING WITH HEAD NOT LOADED OR DOOR OPEN.
- 4 -5V OR -12V TO -15V SELECTABLE FEATURE. SEE PAGE AA001, TABLE II
- 5 CUT TRACE(L) FOR -12V TO -15V INPUT AT L20, R20. SEE PAGE AA001, TABLE II.
- 6 CUT TRACE(R) AND SHORT TRACE(DS) FOR STEPPER POWER FROM DRIVE SELECT.

DAO20

MUST CONFORM TO ENGINEERING SPEC ES 30000-0				EC HISTORY		SHUGART ASSOCIATES			
MATERIAL		TOLERANCE UNLESS OTHERWISE NOTED		DATE	NO	TITLE			
				3-14-4	0114	LOGIC DIAGRAM			
				JAN 76	0485	STEPPER CONTROL			
CASE DEPTH		LINEAR	: XX			DETAIL	3/74	RELEASED FOR ASSEMBLY	
			± XXX			DESIGN		50500	
HARDNESS		ANGULAR±				APPRO	3/74	SHEET 1 OF 1	
SURFACE TREATMENT		ES	CORNERS EDGES BROKEN	OUTSIDE	MAX	C	SCALE	DOC CODE	
			INSIDE	MAX			50504-0	PART NO	
								REV EC	
								0485	

PART NO
50505-0

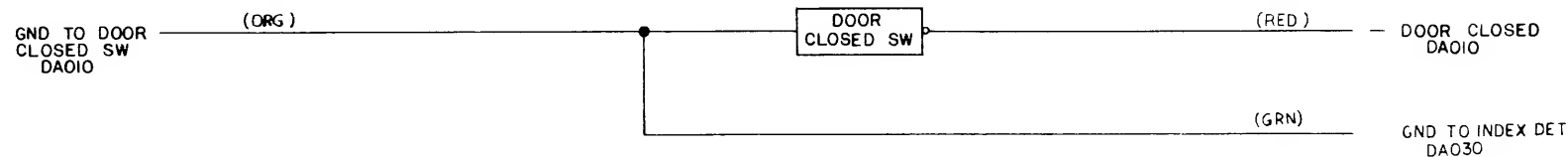
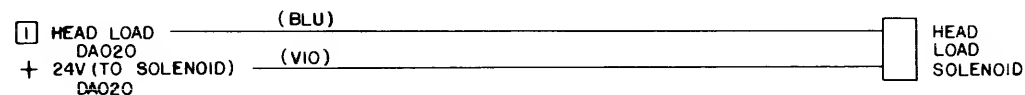
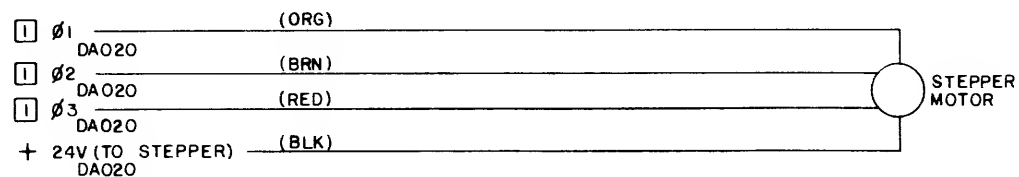
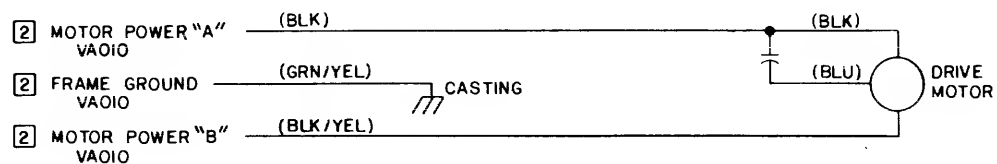


NOTES:

- [1] GND WHEN INACTIVE AND 1.5VDC WHEN ACTIVE.

DAO30

MUST CONFORM TO ENGINEERING SPEC. ES 30000-0		EC HISTORY		SHUGART ASSOCIATES	
MATERIAL	TOLERANCE UNLESS OTHERWISE NOTED	DATE	NO.	TITLE	
		3-16-4	0114	LOGIC DIAGRAM DETECTORS	
CASE DEPTH	LINEAR ± XX	7-23-4	0274	DETAIL	3/74
HARDNESS	± XXX	JAN 76	0485	DESIGN	50500
SURFACE TREATMENT	ANGULAR ±			APPRO	3/74
	CORNERS BROKEN			SCALE	0D
	OUTSIDE MAX			SHEET	OF
	INSIDE MAX			PART NO	50505-0
				REV/EC	0485



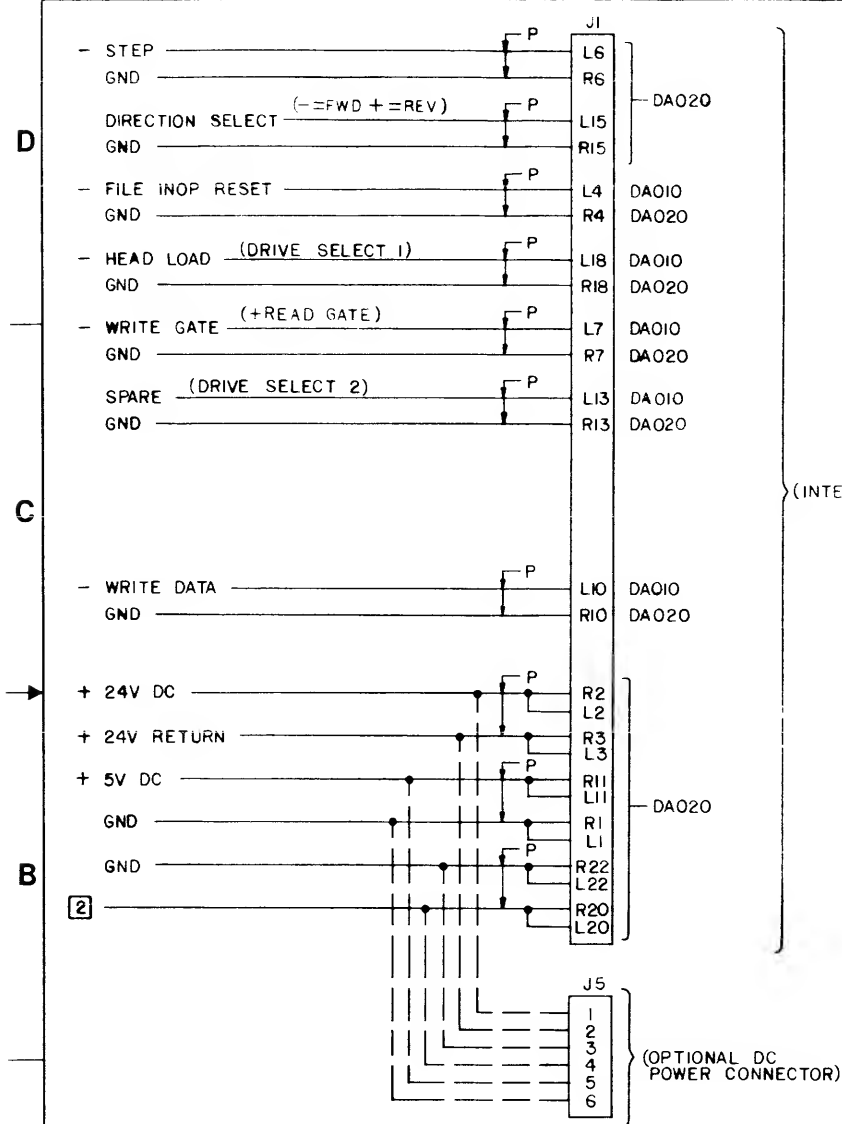
NOTES:

- 1 GND WHEN ACTIVE & +24V WHEN INACTIVE.
2 SEE PAGE VAO10 (NOTE 1) FOR AC VOLTAGES.

DA040

MUST CONFORM TO ENGINEERING SPEC. ES 30000-0			EC HISTORY		SHUGART DESIGNATION		
MATERIAL		TOLERANCE UNLESS OTHERWISE NOTED	DATE	NO	TITLE LOGIC DIAGRAM		
			3-16-4	0114	MOTORS/SOLENOID/SWITCH		
			7-23-7	0274	DETAIL	Inde	3/74
CASE DEPTH		LINEAR ± XX ± .XXX	JAN 76	0485	DESIGN		RELEASED FOR ASSEMBLY
HARDNESS		ANGULAR ±			APPRO	3/74	SHEET 1 OF 1
SURFACE TREATMENT	ES	CORNERS EDGES BROKEN OUTSIDE MAX INSIDE MAX			SCALE	00	DOC CODE
					C	50506-0	PART NO
						0485	REV/EC

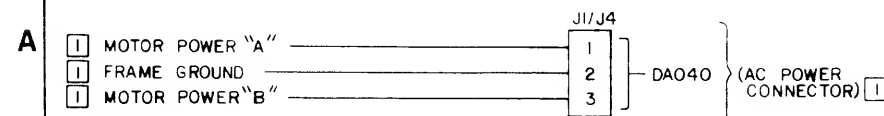
PART NO
50507-0



NOTES: 1

CONN P4	60 HZ		50 HZ	
	110V	208/230	110V	220V
1	110V	208/230	110V	220V
2	FRAME GND	FRAME GND	FRAME GND	FRAME GND
3	110V RETURN	208/230	110V RETURN	220V

2 -5V OR -12V TO -15V SELECTABLE
FEATURE. SEE PAGE AA001, TABLE II.

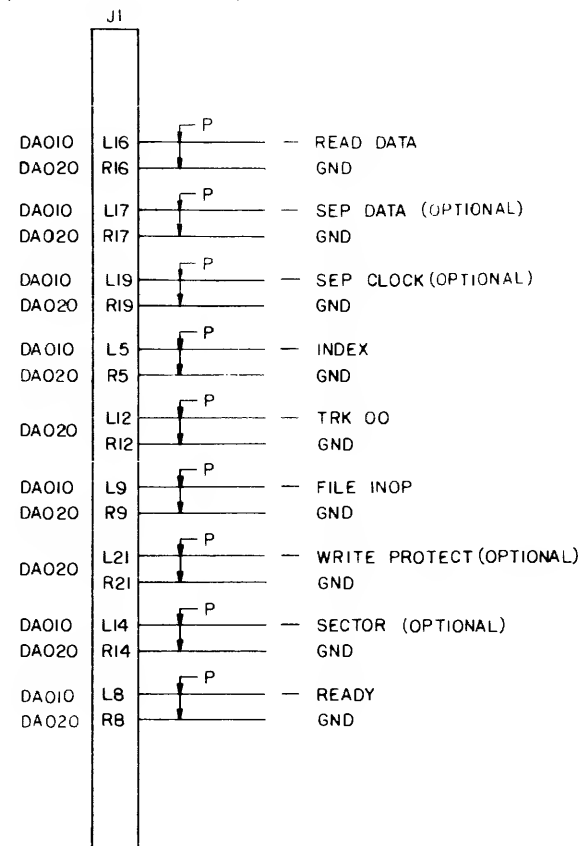


MUST CONFORM TO ENGINEERING SPEC. ES 30000-0		EC HISTORY		SHO PART NO.	
MATERIAL	TOLERANCE UNLESS OTHERWISE NOTED	DATE	NO.	TITLE	LOGIC DIAGRAM
	LINEAR ± XX	3-16-4	0114	INTERFACE INPUTS (J1, J4 AND J5)	
CASE DEPTH	± XXX	JAN 76	0485	DETAIL	3 / 74
HARDNESS	ANGULAR -			DESIGN	50500
SURFACE TREATMENT	ES			APPRD	3/74
	CORNER: EDGES BROKEN	OUTSIDE - MAX		SCALE	00
	INSIDE - MAX			DOC CODE	50507-0
				PART NO	0485
				REV/EC	

VA010

50508-0

(INTERFACE CONNECTOR)



VAO20

MUST CONFORM TO ENGINEERING SPEC. ES 30000-0		EC HISTORY		SHUGART ASSOCIATES	
MATERIAL		TOLERANCE UNLESS OTHERWISE NOTED	DATE	NO	TITLE
			4-16-74	0114	LOGIC DIAGRAM
			1-23-74	0274	INTERFACE OUTPUTS (J1)
CASE DEPTH		LINEAR ± XX	JAN 76	0485	DETAIL
HARDNESS		ANGULAR ± XXX			3/74
SURFACE TREATMENT	ES	CORNERS			DESIGN
		EDGES			3/74
		BROKEN			APPRO
		OUTSIDE — MAX			SCALE
		INSIDE — MAX			DOE CODE
					SHEET
					1 OF 1
					PART NO
					50508-0
					REV/EC
					0485

4

3

2

1

PART NO.
50290-0

LOGIC MANUAL DRIVE SN_____

INDEX

AA001 INDEX
 ABO10 BASIC DRIVE
 DA010 READ/WRITE/INOP CKTRY
 DA020 STEPPER CONTROL/WRITE PROTECT
 DA030 INDEX/READY/SELECT
 DA040 VOLTAGE INTERFACE
 DA050 DETECTORS
 DA060 MOTORS/SOLENOIDS/SWITCHES
 VAO10 INTERFACE INPUT
 VAO20 INTERFACE OUTPUT

TABLE I

PCB ASM NO.	OPTIONAL FEATURES			
	-5V	-12 TO -15V	DATA SEP	
25037	X			
25038		X		
25039	X		X	
25040		X	X	

TABLE III

JUMPER AND CUT TRACE CAPABILITY			
TRACE	DESCRIPTION	OPEN	SHORT
A	MAINTAIN DRIVE 1 STEPPER POWER INDEPENDENT OF SELECT		<input type="checkbox"/>
B	MAINTAIN DRIVE 2 STEPPER POWER INDEPENDENT OF SELECT		<input type="checkbox"/>
C	RADIAL /READY INTERRUPT NOTE ^[2]		<input type="checkbox"/>
D	RADIAL /READY INTERRUPT NOTE ^[2]		<input type="checkbox"/>
E	RADIAL /READY INTERRUPT NOTE ^[2]		<input type="checkbox"/>
F	TERMINATION FOR WRITE DATA		<input type="checkbox"/>
G	TERMINATION FOR FILE INOP RESET		<input type="checkbox"/>
H	TERMINATION FOR WRITE GATE		<input type="checkbox"/>
J	TERMINATION FOR DIRECTION SELECT		<input type="checkbox"/>
K	TERMINATION FOR STEP		<input type="checkbox"/>
M	RADIAL HEAD LOAD NOTE ^[3]		<input type="checkbox"/>
N	RADIAL HEAD LOAD NOTE ^[3]	<input type="checkbox"/>	
P	RADIAL HEAD LOAD NOTE ^[3]		<input type="checkbox"/>
R	RADIAL /READY INTERRUPT NOTE ^[2]	<input type="checkbox"/>	

TABLE II

FACTORY CUT TRACE OPTION		
PCB ASM NO.	TRACE L	
25037	SHORT	
25038	OPEN	
25039	SHORT	
25040	OPEN	

LOGIC MANUAL PN 50268-0

NOTES:

- ^[1] AS SHIPPED FROM FACTORY.
^[2] FOR RADIAL READY INTERRUPT OPEN TRACES C,D,E, AND SHORT TRACE R. READY 1 OUTPUT IS NOW ON PIN J1-L8 AND READY 2 IS NOW ON PIN J1-L14.
^[3] WHEN READY IS NOT RADIAL, PIN J1-L14 CAN BE USED TO LOAD BOTH HEADS TOGETHER INDEPENDENT OF DRIVE SELECT. OPEN TRACES M,P,R, AND SHORT TRACES E,N. ADD JUMPER FROM N TO PIN J1-L14.

AA001

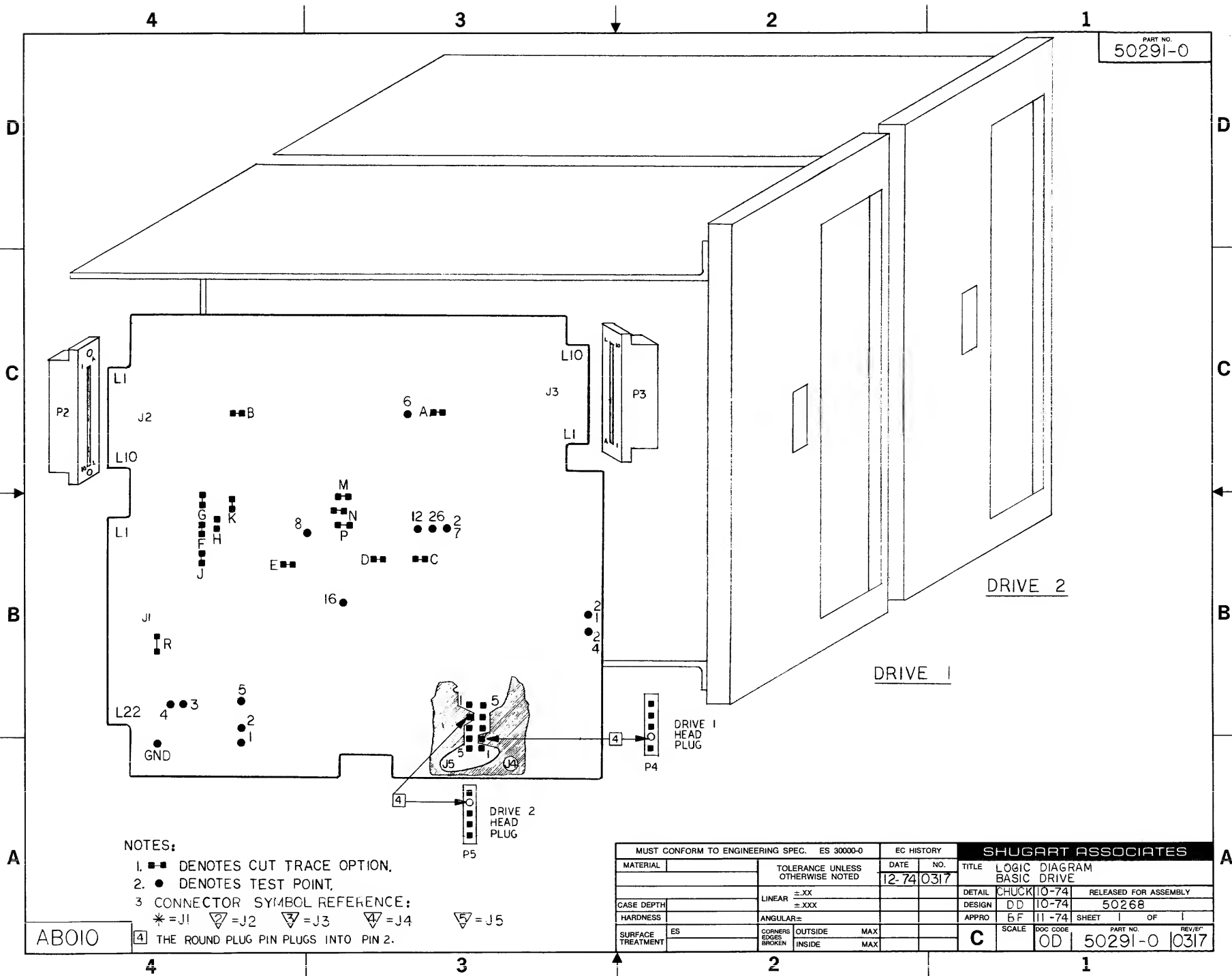
MUST CONFORM TO ENGINEERING SPEC. ES 30000-0		EC HISTORY		SHUGART ASSOCIATES			
MATERIAL		TOLERANCE UNLESS OTHERWISE NOTED	DATE	NO.	TITLE	LOGIC DIAGRAM INDEX	
			12-74	0317			
CASE DEPTH	LINEAR	±.XX			DETAIL	BF	10-74
HARDNESS		±.XXX			DESIGN	DD	10-74
SURFACE TREATMENT	ES	CORNERS BROKEN	OUTSIDE	MAX	APPRO	BF	11-74
			INSIDE	MAX	SCALE	DOC CODE	PART NO.
						OD	50290-0
							REV/EC
							0317

4

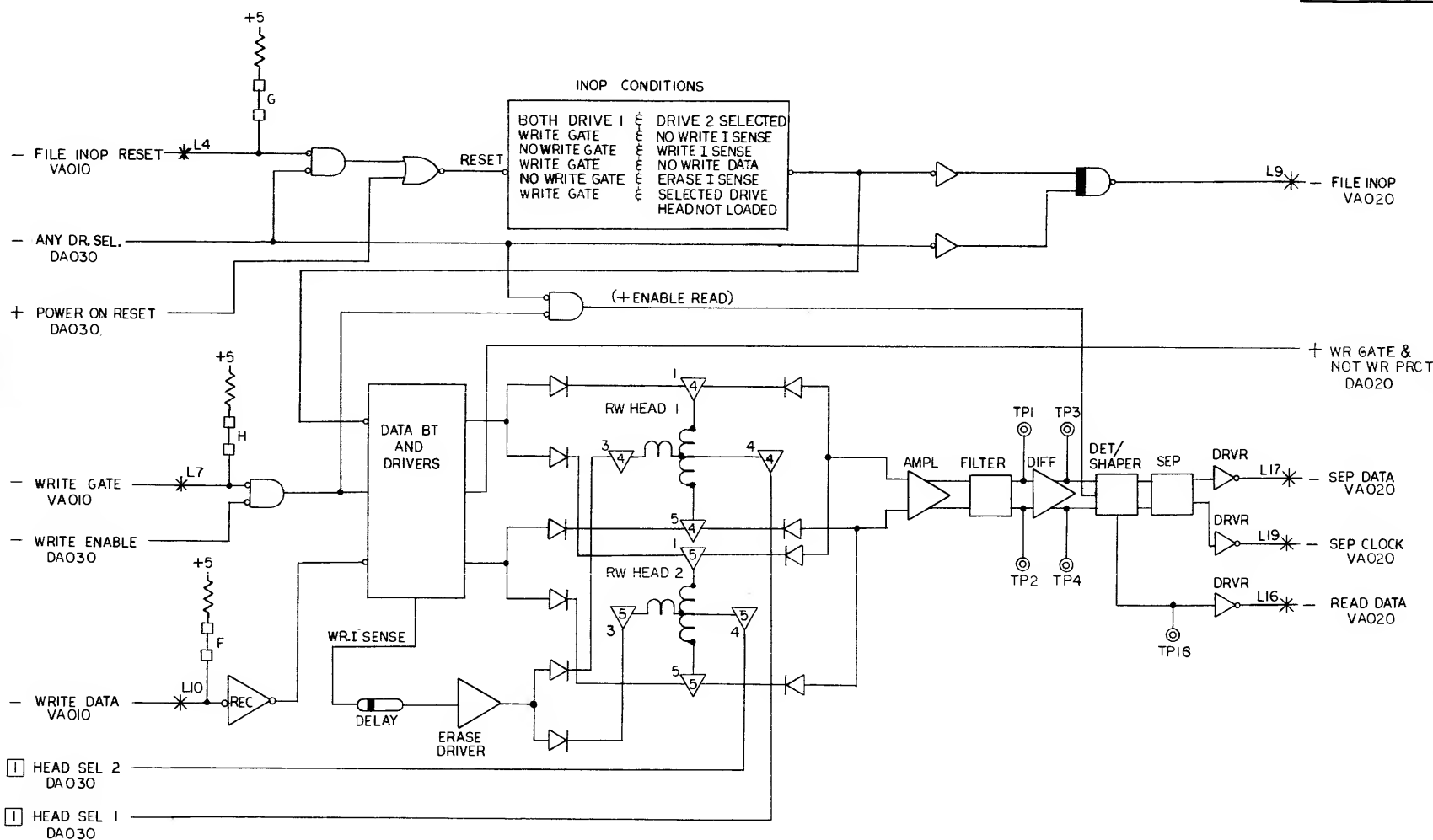
3

2

1

PART NO.
50291-0

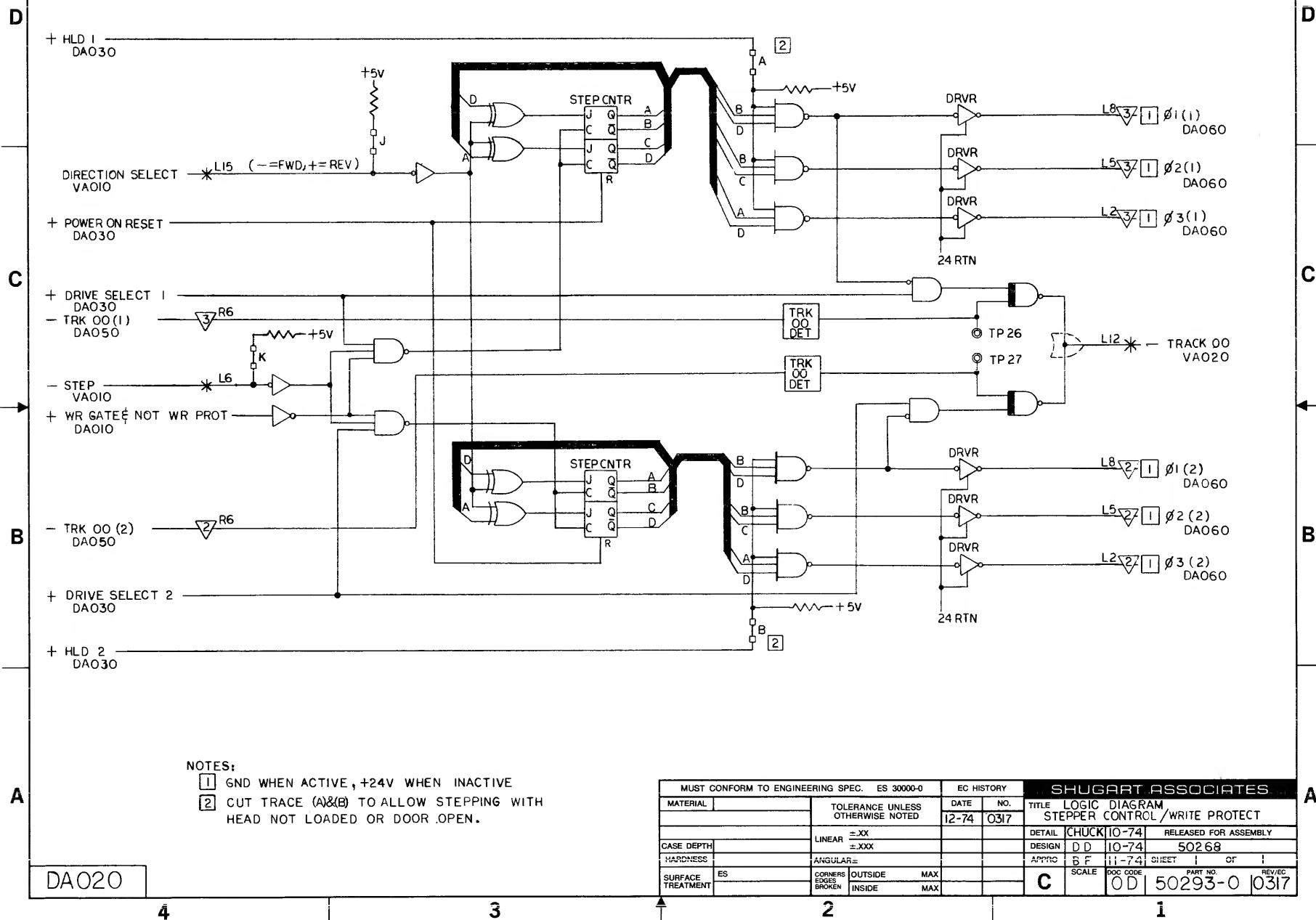
PART NO.
50292-0

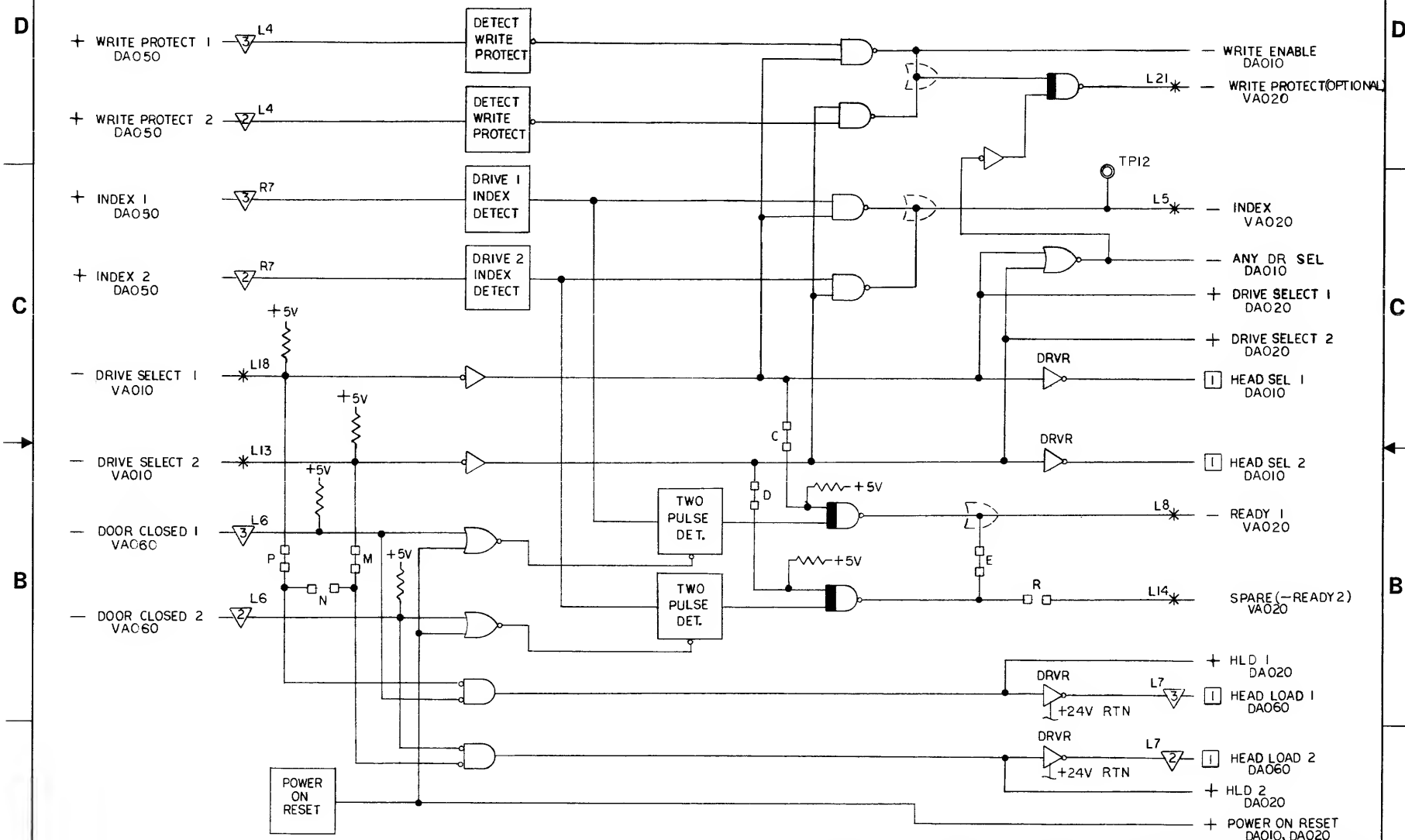


NOTES:
1 GND WHEN ACTIVE, +24V WHEN INACTIVE

MUST CONFORM TO ENGINEERING SPEC. ES 30000-0				EC HISTORY		SHUGART ASSOCIATES			
MATERIAL	TOLERANCE UNLESS OTHERWISE NOTED			DATE	NO.	TITLE LOGIC DIAGRAM			
	LINEAR ±.XX			12-74	0317	READ/WRITE/INOP CKTRY			
CASE DEPTH	±.XXX					DETAIL	CHUCK	10-74	RELEASED FOR ASSEMBLY
HARDNESS	ANGULAR±					DESIGN	D D	10-74	5026E
SURFACE TREATMENT	CORNERS EDGES BROKEN					APPRO	B F	11-74	SHEET 1 OF 1
	ES	OUTSIDE	MAX			SCALE	C	DOC CODE	OD
		INSIDE	MAX					PART NO.	50292-0
								REV/EC	0317

DAO10



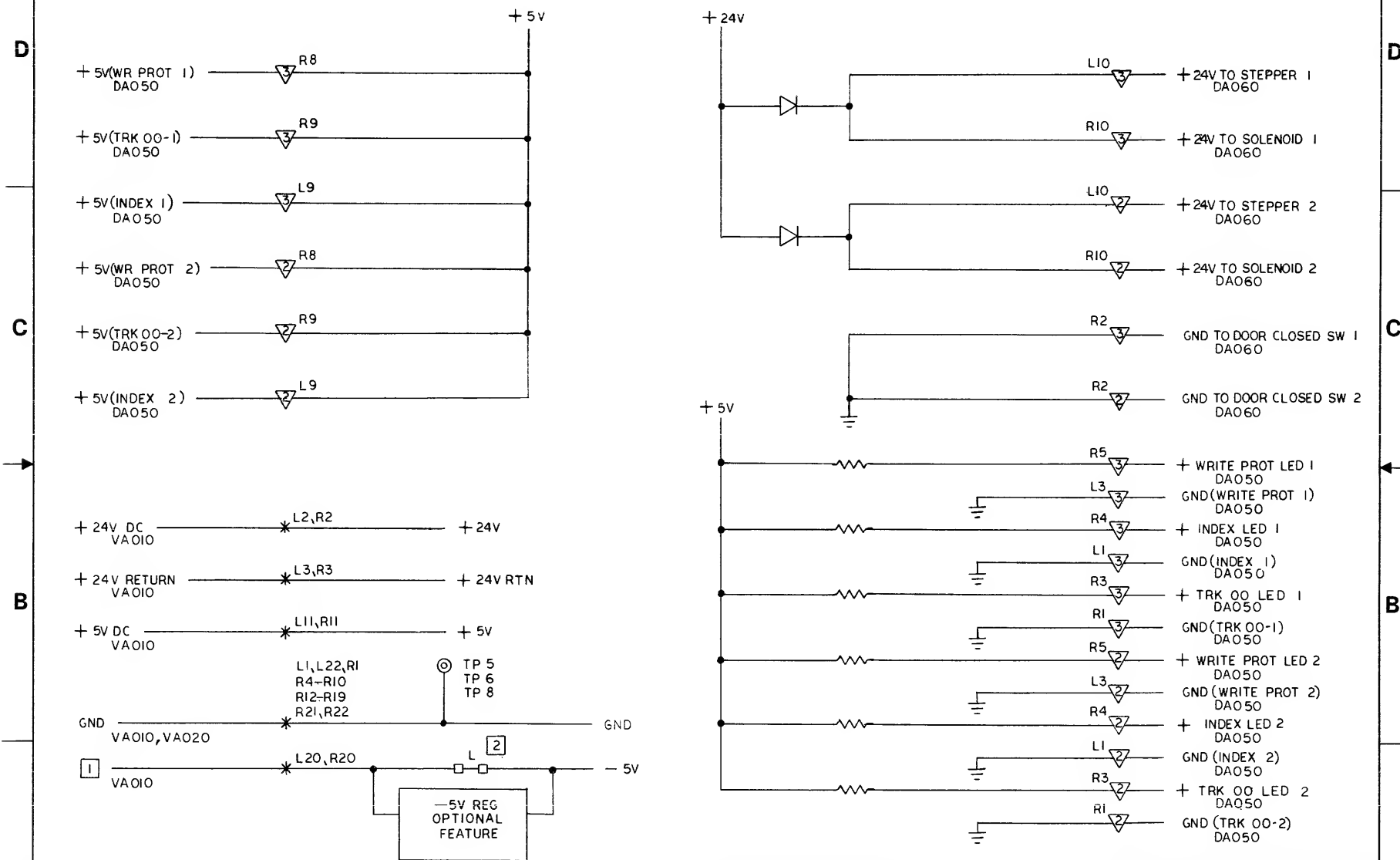
PART NO.
50294-0

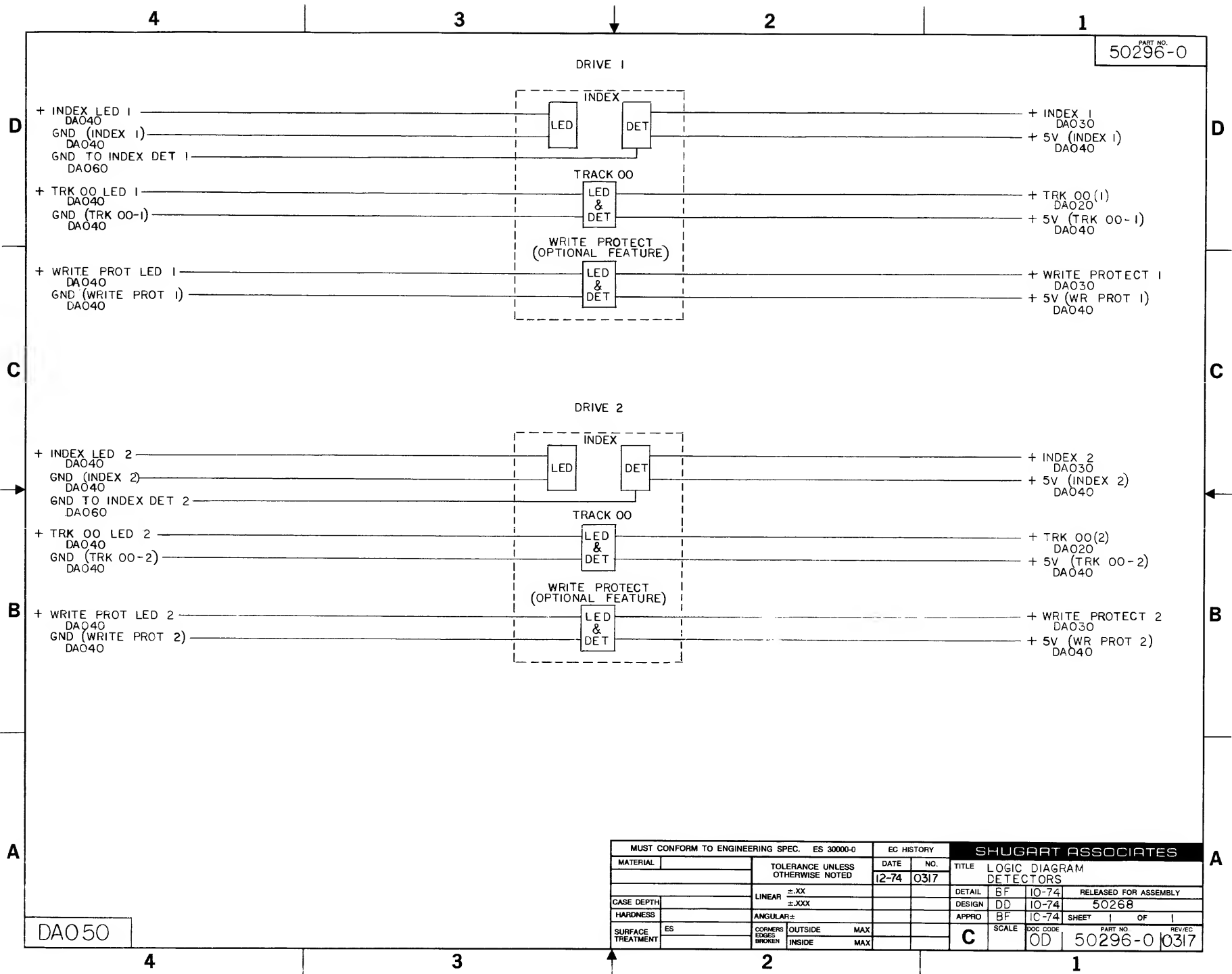
NOTES:

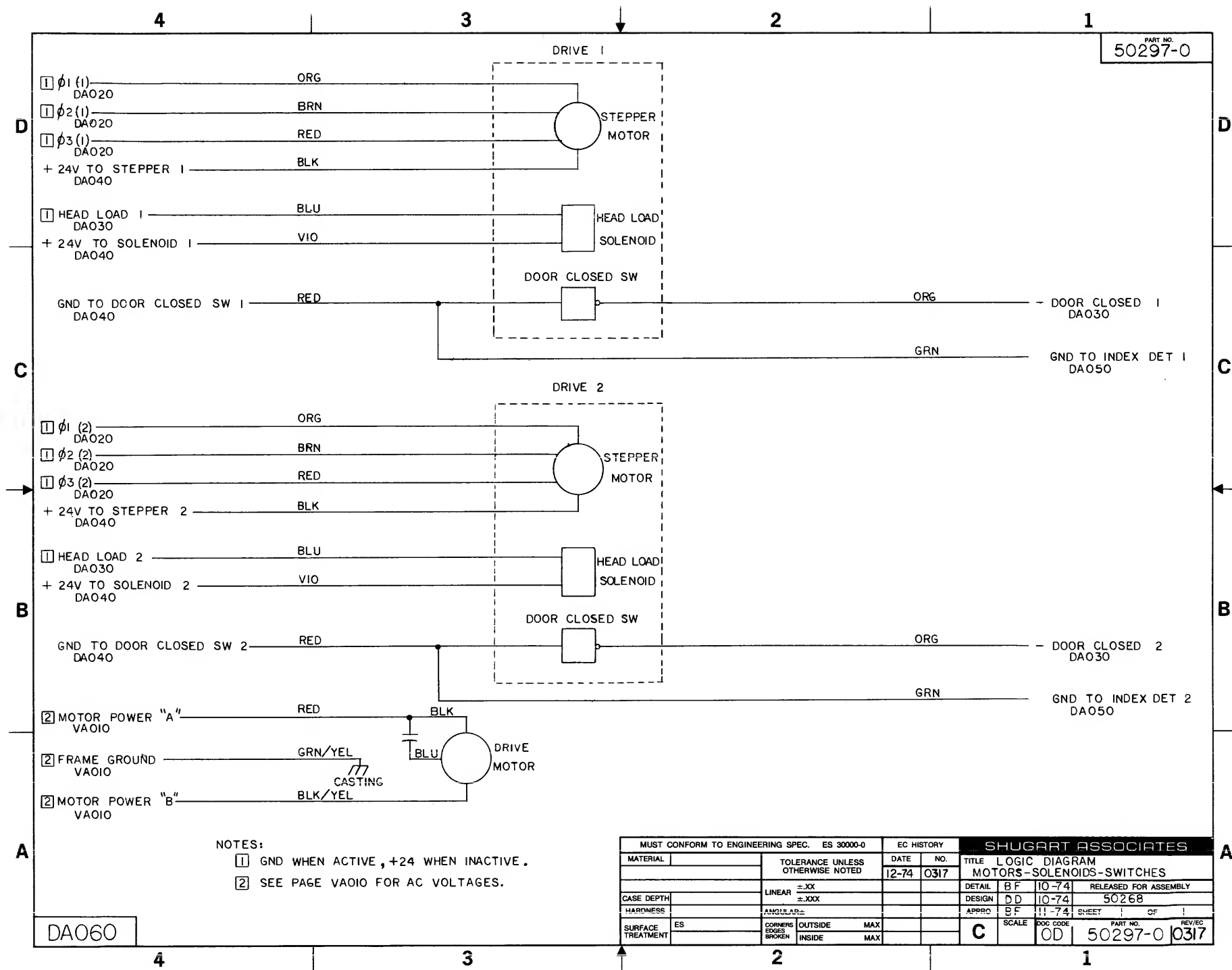
[I] GND WHEN ACTIVE, 24V WHEN INACTIVE

DA030

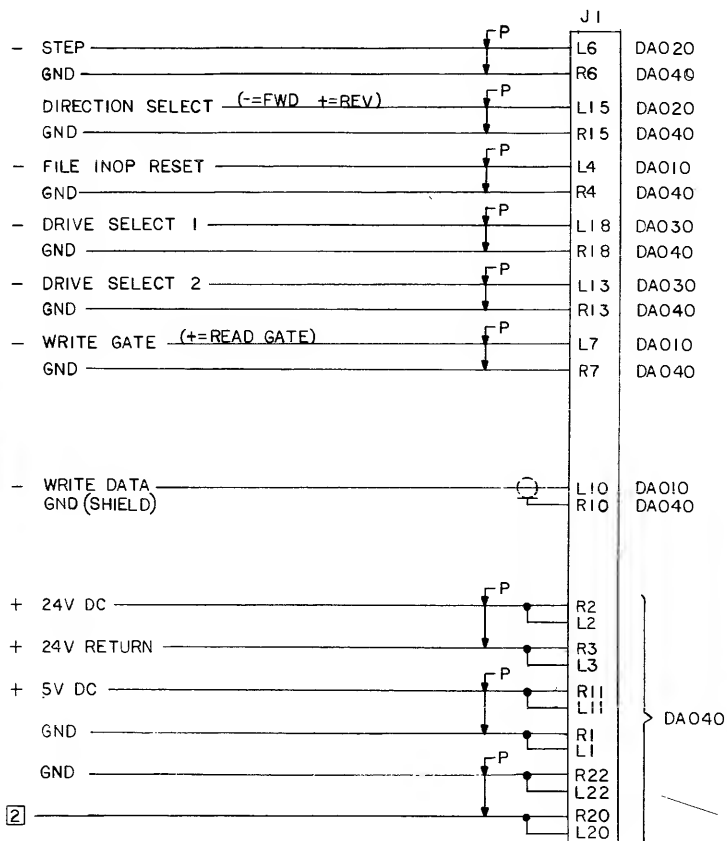
MUST CONFORM TO ENGINEERING SPEC. ES 30000-0				EC HISTORY		SHUGART ASSOCIATES			
MATERIAL		TOLERANCE UNLESS OTHERWISE NOTED		DATE	NO.	TITLE LOGIC DIAGRAM			
				12-74	0317	INDEX / READY / SELECT			
						DETAIL	CHUCK	10-74	RELEASED FOR ASSEMBLY
CASE DEPTH		LINEAR ±.XX				DESIGN	D D	10-74	50268
HARDNESS		ANGULAR ±.XXX				APPRO	B F	10-74	SHEET 1 OF 1
SURFACE TREATMENT		CORNERS EDGES BROKEN		OUTSIDE	MAX				
				INSIDE	MAX				
						C	SCALE	DOC CODE	PART NO. REV/EC
								OD	50294-C0317





PART NO.
50297-0

PART NO.
50298-0

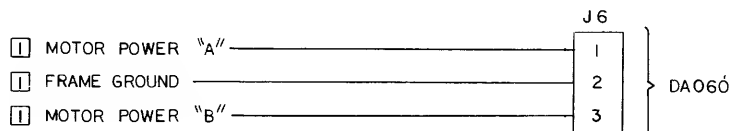


(INTERFACE CONNECTOR)

NOTES: 1

CONN P6	60 HZ		50 HZ	
	110 V	208/230 V	110 V	220 V
1	110	208/230	110	220
2	FRAME GND	FRAME GND	FRAME GND	FRAME GND
3	110 RET	208/230	110 RET	220

2 -5V OR -12V TO -15V SELECTABLE FEATURE.
SEE PAGE AA001 TABLE II.





















AC POWER 1

VA010

MUST CONFORM TO ENGINEERING SPEC. ES 30000-0				EC HISTORY		SHUGART ASSOCIATES			
MATERIAL	TOLERANCE UNLESS OTHERWISE NOTED			DATE	NO.	TITLE	LOGIC DIAGRAM		
				12-74	0317	INTERFACE INPUT			
CASE DEPTH	LINEAR ±.XX					DETAIL	B F	10-74	RELEASED FOR ASSEMBLY
HARDNESS	ANGULAR ±.XXX					DESIGN	D D	10-74	50268
SURFACE TREATMENT	ES					APPRD	B F	11-74	SHEET 1 OF 1
	CORNERS EDGES BROKEN OUTSIDE MAX INSIDE MAX					SCALE	DOC CODE	PART NO.	REV/EC
						C	OD	50298-0	0317

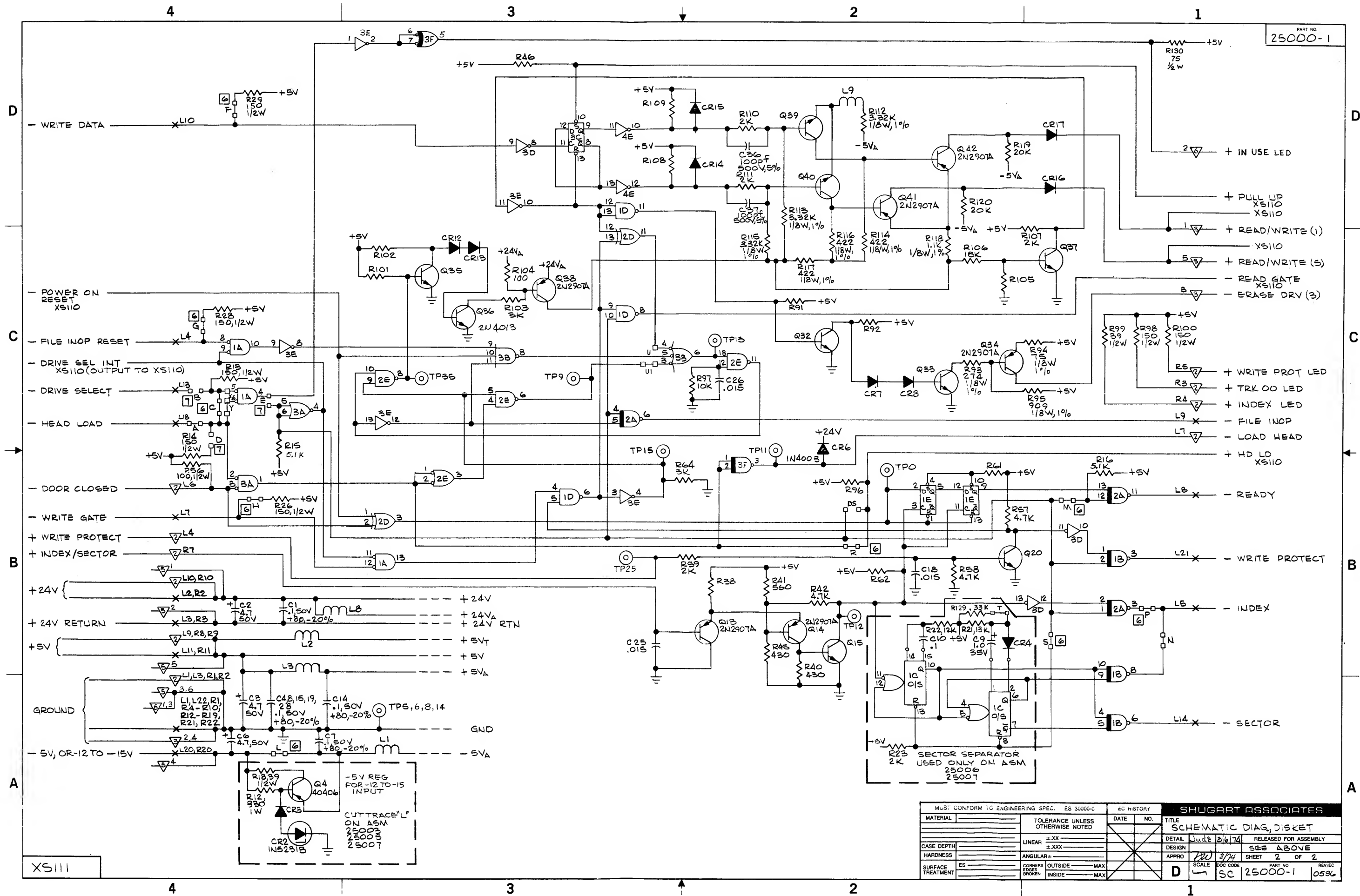
J1

DA010	L16		- READ DATA
DA040	R16		GND
DA010	L17		- SEP DATA
DA040	R17		GND
DA010	L19		- SEP CLOCK
DA040	R19		GND
DA030	L5		- INDEX
DA040	R5		GND
DA020	L12		- TRACK 00
DA040	R12		GND
DA010	L9		- FILE INOP
DA040	R9		GND
DA030	L21		- WRITE PROTECT (OPTIONAL)
DA040	R21		GND
DA030	L8		- READY 1
DA040	R8		GND
DA030	L14		SPARE (- READY 2)
DA040	R14		GND

MUST CONFORM TO ENGINEERING SPEC. ES 30000-0				EC HISTD Y		SHUGART ASSOCIATES			
MATERIAL		TOLERANCE UNLESS OTHERWISE NOTED		DATE	NO.	TITLE			
				12-74	0317	LOGIC DIAGRAM INTERFACE OUTPUT			
		LINEAR ±.XX				DETAIL		B F 10-74	RELEASED FOR ASSEMBLY
CASE DEPTH		±.XXX				DESIGN		D D 10-74	50268
HARDNESS		ANGULAR ±				APPRO		B F 11-74	SHEET 1 OF 1
SURFACE TREATMENT ES		CORNERS EDGES BROKEN		OUTSIDE	MAX	C	SCALE	DWG CODE	PART NO.
		INSIDE		MAX			OD	50299-0	REV/EC
								0317	

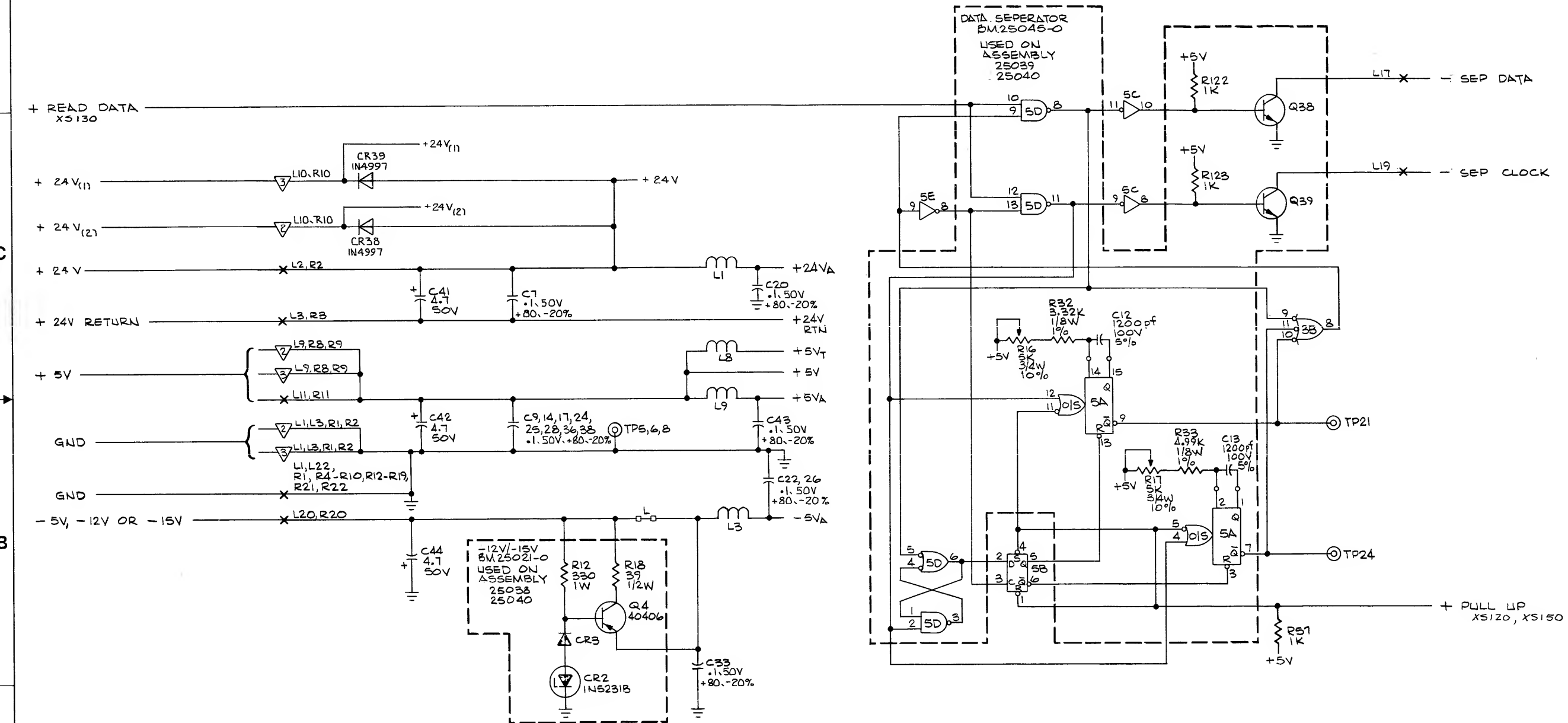
VA020

3.10 900/901 SCHEMATIC DIAGRAMS



3.11 902 SCHEMATIC DIAGRAMS

PART NO	25036-0
USED ON	ASSEMBLY
25037-4	
25038-4	
25039-4	
25040-4	



- NOTES: UNLESS OTHERWISE SPECIFIED;
1. ALL CAPACITORS ARE IN MICROFARADS, 100V.
 2. ALL CHOKES ARE 100 μ H, 10%.
 3. ALL DIODES ARE IN4148.
 4. ALL RESISTORS ARE IN OHMS, 1/4W, 5%.
 5. ALL TRANSISTORS ARE 2N2222A.
 6. CONNECTOR SYMBOL REFERENCES:
(X-11), (X-12), (X-13), (X-14), (X-15).
 7. SYMBOL: -O-O- CUT TRACE CAPABILITY.
:O-O- ADD JUMPER WIRE CAPABILITY.

TYPE	POSITION	UNUSED ELEMENTS	VCC (PIN)	GND (PIN)
7400	5D		14	7
7402	2D, 2E, 5F		14	7
7404	1B, 5E, 2F	1B5	14	7
7406	5C		14	7
7410	3B, 1D, 1E		14	7
7488	4B, 2C, 4E, 3F, 4F		14	7
7417	5B, 4C, 4D		14	7
7476	1C, 1E		5	13
7486	1G		14	7
9602	5A		16	8
7473	6E		-	-

TYPE	POSITION	UNUSED ELEMENTS	VCC (PIN)	GND (PIN)
8T20	5G		-	8
7439	2B		3	12

REFERENCE	DESIGNATION
LAST USED	NOT USED

C48	C-11
CR39	CR3, 10, 26, 27, 28, 29, 30, 31, 32
L9	-
R139	R30
Q48	-
TP27	TP7, 9, 10, 11, 13, 14, 15, 17, 18, 19, 20, 22, 23, 25 (RESERVED)
J5	

MUST CONFORM TO ENGINEERING SPEC. ES 30000-0		EC HISTORY		SHUGART ASSOCIATES	
MATERIAL	TOLERANCE UNLESS OTHERWISE NOTED	DATE	NO.	TITLE SCHEMATIC DIAGRAM	
		10-74	0199	DISKET, 902 (-1) (-2)	
CASE DEPTH	LINEAR \pm .XXX	10-74	0286	DETAIL	10/28/74
HARDNESS	ANGULAR \pm	3-75	0860	DESIGN	10/28/74
SURFACE TREATMENT	CORNERS BROKEN	5-75	0397	APPRO	10/28/74
	OUTSIDE MAX 1-77	12-75	0492	SCALE	10/28/74
	INSIDE MAX	0707		D	10/28/74
				SHEET	1 OF 5
				PART NO	25036-0
				REVISED	0707

XS110



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